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THE NITROGEN-FILLED LAMP.

The paper presented before the American Institute of Electrical Engineers last week by Messrs. Langmuir and Orange, describing the researches leading up to the commercial development of the nitrogen-filled incandescent lamp, as well as the lamp itself, marks an epoch in incandescent-lamp history. While the lamp has already been exhibited in a number of places and its general characteristics have been chronicled in this journal, the paper referred to gives the most complete account of this important piece of work which has yet been made public.

This paper, and the discussion upon it, will serve to clear up a number of questions which have no doubt existed in many minds, regarding not only the new type of lamp, but the older ones as well. The causes of blackening, hitherto suspected to be sure, are now definitely known. Water vapor is the only gas whose presence is deleterious when in the bulb in minute quantities, since its effect is continuous and cumulative. This vapor adheres tenaciously to the surface of the glass bulb or else is occluded within the glass and hence offers the greatest difficulty in exhausting. The use of so-called "vacuum getters" has consequently been necessary, and while phosphorus compounds have been used since the days of the early carbon lamp for this purpose, we are not informed as to the chemical most favored in the case of tungsten lamps.

Of the other gases commonly found as residuals in the exhausted bulb, none are harmful. Argon, when present in small quantities, will cause blackening, but unless especially introduced there is not enough of it in the bulb to be noticeable. On the other hand, if introduced in large quantities, the blackening effect is no longer obtained and it may be used as successfully as nitrogen in the new type of lamp, and may even supplant it if it is found commercially feasible to obtain the gas in sufficient quantity.

The other principal cause of blackening in tungsten lamps is the evaporation of the filament, which condenses again upon the surface of the bulb. This effect limits the useful life of most thick-filament lamps, but in the case of the small sizes using thin filaments, the blackening from this cause is usually quite small up to the time when the filament breaks. The life is usually terminated by breaking of the filament. There is, consequently, no advantage with

thin-filament lamps in filling the bulb with nitrogen, and the status of the small lamp will not be affected by this newest improvement. It is only in the larger sizes using heavy filaments that the increased pressure is an advantage. With increasing size, however, there seems to be no limit, and it is stated that the new type of lamp can be supplied in any size above 500 candlepower which may be desired. The effect of the surrounding nitrogen does not vary greatly with pressure above one-third of an atmosphere, so that it is not important what the pressure within the bulb may be, within this range. Commercially, it is aimed to keep the pressure at less than atmospheric, even when the lamp is hot, and the pressure is, consequently, not more than about two-thirds of an atmosphere when cold. The temperature of the filament is said to be 500 or 600 degrees centigrade higher than that of the ordinary tungsten lamp.

The possibility of using a double envelope around the filament in order to combine the advantages of gas pressure on the filament with the insulating effect of a vacuum was not discussed. It might seem feasible to mount the filaments, in the case of large sizes of lamps, in a sort of closed Dewar flask, filling the inner inclosure with nitrogen, while the outer envelope of vacuum would prevent the rapid escape of heat. Such an arrangement would probably result in the inner glass wall attaining too high a temperature, but such a suggestion would seem to offer opportunities for experiment.

CENTRAL-STATION SUPPLY.

That a large plant for the generation of power such as is maintained by a central-station company can generate that power at a unit cost much less than is possible in the small plant was ably demonstrated in the paper presented by Mr. Paul M. Lincoln at the meeting of the American Institute of Electrical Engineers held this week in Philadelphia. The reasons advanced by Mr. Lincoln for the possibility of cheaper generation in the large plant than in the small one are not new, but they were so simply and convincingly stated as to leave no doubt in the minds of his hearers as to the conclusiveness of the arguments. Much greater differences in costs per unit of capacity exist in machinery and apparatus of large and small sizes than some will realize who have not closely investigated this matter, while the economies in operation are perhaps more generally recognized. The two large items of fixed charges and operating charges can both be greatly reduced in a large plant when referred to the unit of output.

The great diversity of different loads when supplied from a single power plant is another large item in favor of central-station supply, inasmuch as the plant capacity required is not nearly so great as the sums of the capacities which would be required in individual plants. These three considerations establish irrefutably the possibility of cheaper production of power in the large central plant.

The question of the cost of central-station power does not end here, however. In order to supply its customers, the central station must invest in an extensive and expensive distribution system, and the fixed charges of this, as well as the small percentage of energy which is dissipated in it, must be added to the cost of delivered power. The investment in the distribution system is, perhaps, greater than many persons will realize, and in many instances involves a greater outlay of capital than that involved in the generation of the power. As an example of this, reference may be made to the appraisal of the plant of the Commonwealth Edison Company, of Chicago, made in 1908 by H. M. Byllesby & Company. While it is not easy to distribute the value of all items in such a report, an approximate summary indicates that the distribution system has not only cost more than the generating plant, but that it is from 30 to 40 per cent greater than the latter. Probably a similar ratio would apply in any large city. It is then evident that the saving in power generation must be sufficient to cover the fixed charges on this additional capital in order to maintain its advantage of less cost.

There are, of course, other reasons than those above mentioned why central-station power can be supplied more cheaply than in an isolated plant and why it may be more desirable, even though the cost is no less. The fact that its generating units are usually more modern and therefore more efficient regardless of their increased size, that they usually operate closer to rated load, and with a greater reliability of operation are all points to be considered.

The argument that the generation of power is little more than a by-product where a boiler plant must be maintained for heating purposes was not overlooked by Mr. Lincoln, although it was not very fully discussed in the paper referred to. This argument is undoubtedly overworked in many instances, since the maximum demands for power and for heat are seldom simultaneous and it is only during a small portion of the year that the full capacity of a heating plant is required. During the summer season no heat whatever is required for this purpose and the power plant operates under all the disadvantages of any small plant. On the other hand, where steam is required in large quantities for industrial purposes throughout the working day, it may easily be the case that the extra cost of generating power is very small and that the central station has no opportunity for supplying electric current unless it can also supply live steam. It is as well for central-station managers to recognize that such exceptional cases as these are not within their province, but direct their efforts to convert the isolated-plant owner whose operating conditions are not favorable, and who frequently does not know what his power is costing when all elements of cost are considered. His name is legion.

In this connection attention is called to the article by

Mr. C. A. Fees, beginning on page 765, in which the determination of the operating cost of an isolated plant is discussed. The difficulty of making the plant owner realize all the elements of cost entering into his production of power is emphasized and this is really one of the obstacles in the way of the introduction of central-station service. If all plant owners realized the total cost of their power production, many of them would rush to sign a central-station contract. The considerations to be taken into account in installing electric drive are also discussed by Mr. Fees. While individual drive offers perhaps the ideal mechanical arrangement, considerations of cost often make it necessary to install group drive, and a careful study is required in each case to determine which arrangement is best suited to the work to be done.

ANOTHER VICTORY FOR WIRELESS.

The disaster which occurred to the steamer *Volturno* in mid-ocean last week, when fire broke out on the ill-fated ship during a severe storm near the spot where the *Titanic* went down, presented another opportunity for radiotelegraphy to demonstrate its value and indispensability to mankind. It looked as though all on board must be lost. The wireless call of distress, however, revealed the predicament of the vessel and her precious cargo of over 600 human beings to a number of other trans-Atlantic liners which were within calling distance. Altogether 12 of these were brought by the wireless signals within hail of the *Volturno*. Unfortunately the heavy seas did not permit of immediate rescue and a shockingly large number of lives were lost in an attempt to leave the burning vessel. Radiotelegraphy had performed its mission, however, and the rescuers were on hand to perform their service as soon as the condition of the sea would permit. To its aid must be credited the saving of over 500 of the passengers and crew, who would otherwise have run a large chance of being lost. Perhaps the presence of a better disciplined and drilled crew would have made possible the saving of other lives which were, unfortunately, sacrificed. It is probable that an equipment of breeches buoys on some of the vessels would have facilitated more prompt rescue.

Each instance of this kind forms a justification for the legal requirement that all vessels at sea should be supplied with wireless equipment and that this should apply not only to passenger vessels, but to freighters as well. Since electrical science has placed at the disposal of mankind a means of communication between any ship and its neighbors in a radius of hundreds of miles, the possibility of lacking such service in time of need should be removed. It is doubtful if any invention of man is responsible for the saving of so many lives in the short period of its practical application, and its record in the future will, undoubtedly, enhance its reputation in this regard.

ELECTRIC DRIVE FOR ROLLING MILLS.

At the annual convention of the Association of Iron and Steel Electrical Engineers, which was reported two weeks ago, the question of the advantage of electrical drive came up in connection with two of the papers. One of these papers was by a manufacturer of electrical machinery and the other by a mill engineer. The testimony of both was to the effect that electric motor drive on main rolls is considerably more efficient than steam drive and not only reduces cost of operation but results in greater production and greater reliability of operation.

That this is true of the three-high mill has been generally acknowledged, because in this case there is a constant direction of rotation and flywheels may be provided to reduce the peak load upon the motor. In the case of reversing mills, the advantages of electric drive are not so apparent and although they have been installed in many cases, there are those who claim they are not so advantageous as steam drive when the cost of installation as well as that of operation is taken into consideration.

To obviate the difficulty of reversing the motor at each pass in a two-high mill, a novel proposal was made at a meeting of the (British) Iron and Steel Institute not long since by Mr. Andrew Lamberton. The scheme proposed is based upon the idea that with constant direction of rotation the direction of the pass is reversed if the lower roll is brought into the upper position. Mr. Lamberton has worked out a design in which this idea is applied, but it is a question whether the complications thus introduced do not overbalance the advantages actually gained.

To accomplish the reversal of position of the two rolls, they are mounted in circular gables which are free to rotate in fixed frames or housings. By rotating these gables through exactly 180 degrees between passes, the successive passes will occur in opposite directions. The rotation of the gables is accomplished by mounting them on anti-friction rollers, which are geared through a pinion to a long rack, and the latter is given a horizontal stroke of the proper length by means of hydraulic rams. The reversal can be accomplished in three to five seconds. It is necessary also to make provision for driving the rolls in their changed positions and this also has been cleverly worked out by special gearing.

One advantage claimed for the new mill is that in rolling the rails and similar sections in the ordinary type of two-high mill it is necessary to turn the bar upside down to prevent the formation of fins. This is obviated in the new design because the rails take alternately top and bottom position.

A mill of this type is now in course of construction in England and it will be of great interest to learn how the cost of installation and operation compares with previous types.

Exhibits at First National Mining Exposition.

The First National Mining Exposition opened in Horticultural Hall, Philadelphia, Pa., on October 17, under the auspices of the American Mining Congress, has proved a success far beyond the expectation of its promoters. Conceived but three months ago, its success was assured fully a month ago. Now it gives every promise of being one of the greatest trade gatherings ever held in this country and destined to result in great good to the mining industry.

The response made by the mining men of the United States to the call for this exposition only serves to indicate what a real need there had been existing for such an exposition. It was quickly realized that this would not be merely a show for the curious, with doubtful results to the exhibitors. The American Mining Congress, which is to hold its convention next week will bring to Philadelphia more than 2,000 of the leading mining men of the country and these will attend the exposition in addition to the men who are coming solely for the exposition.

Among the many exhibitors the following are of electrical and allied interest: Westinghouse Electric & Manufacturing Company, East Pittsburgh, and Baldwin Locomotive Works, Philadelphia, mine locomotives; Western Electric Company, Chicago, mine telephones; Streeter-Amet Weighing & Recording Company, Chicago, automatic weight recorder for mine tipple scales; Hirsch Electric Mine Lamp Company, Philadelphia, miner's cap and lamp; Henry Troemner, Philadelphia, assay and analytical balances; Keuffel & Esser Company, Hoboken, N. J., mathemetical and surveying instruments; C. O. Bartlett & Snow Company, Cleveland, O., working model of a complete coal-handling plant; American Tempering Company, Springfield, Ill., a system of welding; Link Belt Company, Chicago, elevating, conveying and transmission machinery; Fairmont Mining Machinery Company, Fairmont, W. Va., portable electric mine pump, etc.; Dräeger Oxygen Apparatus Company, Pittsburgh, Pa., life-saving apparatus; General Electric Company, Schenectady, N. Y., electrical machinery and appliances; Jeffrey Manufacturing Company, Columbus, Ohio, storage-battery locomotive, etc.; John A. Roebling's Sons Company, Trenton, N. J., wire ropes and cables; Electric Storage Battery Company, Philadelphia, storage batteries designed for mine locomotives; Goodman Manufacturing Company, Chicago, coal-mining machinery; Edison Storage Battery Company, Orange, N. J., storage batteries and electric mine lamps.

Effect of Surrounding Globes on Incandescent Lamps.

Gustaf Sunden has described in *Elektrotechnische Zeitschrift* some experiments upon the effect of surrounding metal-filament lamps with an outer globe. The actual experiments were performed by surrounding the lamp with heat-insulating material in a metal tube so that a temperature of 200 degrees centigrade could be maintained. Others were operated at a room temperature of 20 degrees and others were cooled to 2.5 degrees by running water.

The lamps were tested from time to time for mechanical strength of the filament in a shock apparatus. It was found that the lamps at 2.5 degrees retained their strength. The lamps at 20 degrees deteriorated slowly, while those at 200 degrees deteriorated very rapidly.

The actual temperature reached in an ordinary clear-glass globe was found to be 70 degrees centigrade; with a dusty globe a still higher temperature was reached.

Convention of Association of Railway Electrical Engineers.

The sixth annual convention of the Association of Railway Electrical Engineers will be held at the Hotel La Salle, Chicago, October 20 to 24, inclusive.

In connection with the convention there will be a very comprehensive exhibit of electrical devices by the different manufacturers, the whole top floor of the Hotel La Salle having been reserved for this purpose.

It is expected that this will be the largest and most important convention yet held by this association, and all of the principal railroads in the United States and Canada will be represented. A program of papers and reports to be presented will be found in last week's issue.

Meeting at Massachusetts Institute.

The Electrical Engineering Society of the Massachusetts Institute of Technology gave a reception to members of the sophomore and junior classes who specialize in electricity, on October 8. Professor D. C. Jackson gave an address on "The Relation of the Society to the Institute," and Professor Harold Pender spoke on "The Objects of the Electrical Engineering Research Department."

Test of Jupiter is Successful.

The United States ship *Jupiter*, designed for electrical propulsion, has been undergoing a builders' trial trip, which has been reported to the officials of the Navy Department as entirely successful.

Railway Associations Conventions.

The conventions of the American Electric Railway Association and its affiliated engineering, accountants, traffic and claim associations, opened at Atlantic City, N. J., on October 13, with an attendance of over 5,000. The opening session of the American Electric Railway Association was called to order by the president, Gen. George H. Harries, on Tuesday afternoon.

The exhibits were more extensive and complete than ever before, covering the entire floor space of the mammoth million-dollar pier. H. G. McConnaughy, the presiding genius of the well-arranged exhibit, received many commendations and congratulations. Among the prominent exhibitors were the General Electric Company, Westinghouse Electric & Manufacturing Company, Weston Electrical Instrument Company, Allis-Chalmers Manufacturing Company, American Steel & Wire Company, Barnes & Kobert Manufacturing Company, D & W Fuse Company, General Vehicle Company, Independent Lamp & Wire Company, H. W. Johns-Manville Company, National Carbon Company, the National Quality Lamp Division of the General Electric Company, Okonite Company, John A. Roebling's Sons Company, Sangamo Electric Company, Speer Carbon Company, Standard Paint Company, Standard Underground Cable Company and the Western Electric Company.

Electrical Exports for August.

The following data relating to electrical exports from the United States for last August are obtained from the monthly summary of imports and exports issued by the Bureau of Foreign and Domestic Commerce, Washington, D. C.

Although the total value of the electrical shipments was slightly less in August than in the preceding month, it exceeded the total of August, 1912, by nearly $180,000. The number of articles shipped in the four classes for which the numbers are reported, were as follows in August: electric fans, 3,585; arc lamps, 633; carbon-filament lamps, 130,285; metal-filament lamps, 64,566.

In the following table are given the classified figures for last August and also for the corresponding month of a year ago, as far as the detailed figures for the latter are available.

Articles	Aug., 1913	Aug., 1912
Batteries	$ 45,526	.....
Dynamos and generators.	134,136	$364,044
Fans	46,408	24,637
Insulated wire and cables	219,736	.....
Interior wiring supplies, etc. (including fixtures)	66,385	.....
Lamps—		
Arc	10,387	26,069
Carbon-filament	15,835	10,765
Metal-filament	16,305	38,960
Motors	419,280	281,200
Static transformers	156,727	.....
Telegraph instruments (including wireless apparatus)	6,425	23,840
Telephones	189,160	92,523
All other	952,705	1,238,723
Total	$2,279,015	$2,109,761

Duncan T. Campbell.

In making its report to the Pennsylvania Electric Association in annual convention at Delaware Water Gap, Pa., September 18, the Nominating Committee appointed to select the officers for the ensuing year prefaced its recommendations with the statement that it (the Committee) had selected those men best fitted by knowledge and experience to guide the affairs of the Association. It is indeed fitting, therefore, that the highest honor that could be conferred by this organization should be bestowed upon Duncan T. Campbell, of Scranton, who by reason of his extended central-station experience is eminently qualified for the position.

Mr. Campbell was born in Glasgow, Scotland, on December 7, 1875, and when 21 years of age came to the United States. In 1900 he entered the employ of the Denver (Colo.) Gas & Electric Light Company as a solicitor in the new-business department. During the six years which Mr. Campbell was affiliated with the Denver Company he became thoroughly versed in all phases of new-business methods. He left Denver in 1906 to take charge of the new-business department of the central-station company at Grand Rapids, Mich., going to Scranton, Pa., one year later as new-business manager of the Scranton Electric Company. At Scranton, Mr. Campbell instituted progressive and aggressive business-getting methods and soon established a record for new business that attracted the attention of the central-station world. In 1910 he was appointed general manager, and early this year he was elected a vice-president of the company.

For the past five years Mr. Campbell has been active on the different committees of the Pennsylvania Electric Association, serving on the Executive Committee of the Association for the past two years. Mr. Campbell is a member of the National Electric Light Association, the Illuminating Engineering Society, the Engineers' Society of Northeastern Pennsylvania and the Society for Electrical Development, in addition to numerous fraternal societies.

Duncan T. Campbell,
President, Pennsylvania Electric Association.

California Power Development.

A water-power permit has just been granted by the Secretary of Agriculture to the Truckee River General Electric Company, a California corporation, under which this company will develop power on the Eldorado national forest, to serve various California towns and cities.

In developing power the company states that it expects to construct seven reservoirs, five for water storage and two for equalizing the flow. Two of the storage reservoirs are on Upper Rubicon River. By the use of a tunnel, approximately a mile and a half long, the flow of the Upper Rubicon River and the waters stored in these two reservoirs will be brought into the Gerle creek drainage where the waters will be further stored. From this storage the water will be conveyed by ditches and natural streambeds to Pilot creek, upon which the two power plants mentioned in the permit are to be located. The water will finally be discharged into the Rubicon River.

At each of the two plants there will be a head of approximately 1,300 feet. The company expects to make an initial installation which will develop about 16,000 horsepower, which will probably be doubled as the market for the product increases.

American Foundrymen's Association.

At the Chicago convention of the American Foundrymen's Association, which will be held at the Hotel La Salle, October 14 to 16, several matters of interest to electrical men will be considered. The most important of these will be a paper by Albert Hiorth, of Norway, entitled "The Electric Furnace for Steel Castings," which will be read Wednesday morning.

Program of Electric Vehicle Association of America.

The program for the convention of the Electric Vehicle Association of America, which will be held in Chicago on October 27 and 28, has been completed and includes some very interesting papers relative to electric-vehicle development and use. Sessions will be held both morning and afternoon of both days. Headquarters will be established at the Hotel La Salle.

At the opening session Arthur Williams will deliver the presidential address, which will be followed by reports of the various standing committees and the report of the Committee on Rates and Charging Stations, of which John F. Gilchrist is chairman. There will also be a paper by Henry Wardrop, entitled, "The Past, Present and Future of the Electric Power Wagon."

At the afternoon session a general discussion on "What the Sections Are Doing" will be led by the chairmen of the various geographical sections including Homer E. Neisz, of Chicago; J. A. Hunnewell, of the New England Section; Harvey Robinson, of New York, and Day Baker, representing the Electric Motor Car Club of Boston. At this session papers will also be presented as follows: "Traffic Problems and the Automobile," by E. E. Pratt, of New York; "The Merchant, The Central Station and the Electric Truck," by F. Nelson Carle; and "Co-operation Between the Electric Vehicle Manufacturer and the Central Station," by E. L. Callahan, of Chicago.

The papers for Wednesday morning session include "Charging of Storage Batteries in Unattended Garages," by Maxwell Berry; "Electric Vehicle Salesmanship," by George H. Kelly and E. J. Bartlett; "The Electric Vehicle in Department-Store Service," by C. A. Duerr and David F. Tobias, and "Recent Developments in the Lead Battery for Electric Vehicles," by Bruce Ford.

The program for the final session on Tuesday afternoon includes a paper by F. E. Whitney on "The Electric Commercial Vehicle Tires"; a talk by Ralph Temple on "How to Make the Business Help"; and a report of the Committee on Publicity and Advertising, of which Frank W. Smith, of New York, is chairman. The election of officers will take place on Tuesday morning.

The various entertainment features arranged for this convention have been announced in these columns.

Activity of Boston Electric Motor Car Club.

The relation of the Boston Electric Motor Car Club to the New England Section, Electric Vehicle Association of America, and a closer definition of the scope of work which each should do, was the subject of discussion at the annual meeting of the former organization at Hotel Thorndike, Boston, October 8. The following participated in the discussion: M. J. Fitch, F. J. Stone, Albert Weatherby, C. D. Marsh, D. C. Tiffany, J. S. Codman, P. E. Whiting, A. F. Neale, E. S. Mansfield, and President Day Baker. A part of the members thought the club's activities should be enlarged to include educational work for owners and drivers, while others felt that this should be the function of the Electric Vehicle Association, the club remaining a purely trade organization. As the result of the de bate a conference will be held by the executive committees of the two organizations with a view to arriving at a definite policy.

New members were added as follows: W. G. Bottom, Anderson Electric Car Company; A. D. Baird and C. H. Miles, Boston Edison Company.

The subject of an exhibition of pleasure cars at the Copley-Plaza Hotel was considered, and another conference with the Edison Company, which proposes to finance the show, and with the hotel management, relative to open dates either in November or soon after New Year's, will be held.

O. G. Draper, master of transportation, outlined plans for the trip to Chicago to attend the convention of the Electric Vehicle Association of America. A badge will be designed to be worn by the Boston contingent.

The treasurer, J. S. Codman, presented his report and the following officers were elected for the ensuing year:

President, Day Baker; vice-president, E. S. Mansfield; secretary, L. L. Edgar; treasurer, J. S. Codman. Executive Committee, Albert Weatherby, F. J. Stone, A. E. Carpenter. Meetings Committee, D. C. Tiffany, J. W. Emery, L. R. Vredenburg. Advisory Committee, Col. E. W. M. Bailey, J. W. Bowman, R. B. Daggett, W. E. Eldredge, E. A. Gilmore, R. C. Gregg, G. W. Holden, J. C. Mackay, J. L. Morris, F. N. Phelps, J. L. Snow. Finance Committee, M. J. Fitch, R. S. Hale, H. S. Potter.

A new member, C. H. Miles, of the Boston Edison Company, said that the interests of that company are identical with those of the dealers in vehicles. He praised Mr. Mansfield's work in connection with electric vehicle interests in Boston.

O. G. Draper proposed that meetings of the club be held in Portland, Providence and other New England cities, to interest people there. It was also suggested that special meetings be held in Boston—an owners' night, ladies' night and commercial night—to enlist the interest of various groups.

Converse D. Marsh advocated large activities for the club, with particular reference to interesting owners of electric vehicles.

A cup was exhibited which has been subscribed for by club members and which will be sent to Joseph E. Baker, formerly of Boston but now of the Washington Waterpower Company, as a token of the club's appreciation of Mr. Baker's work while a member.

New Power Concerns Chartered.

In pursuance of its policy to control the power plants throughout the territory traversed by its lines, interests allied with the Lehigh Valley Transit Company have secured charters for eight new electric companies, seven of which are to operate in Schuylkill County, with a capitalization of $5,000 each, and one in Northampton County in Pennsylvania.

Those issued in Schuylkill County were granted to W. B. Rockwell, Ira G. Walborn and Van Dusen Rickert of Pottsville, for the Eastern Pennsylvania Light, Heat & Power Company to operate plants in Ryon, Centralia, Girardville, Butler, Gilberton, Conyngham, and West Mahonoy township. For the Edison Illuminating Company of Easton a charter was issued to H. R. Fehr, the new president of the Lehigh Valley Transit Company; H. J. Steele, S. H. Hackett of Easton; W. H. Walters, Phillipsburg, N. J.; J. C. Dawson, Thomas Newhall, W. A. Sterne and A. L. Smith of Philadelphia. It will be capitalized for $350,000.

Convention Delegates Travel by Trolley.

More than one hundred New England street railway men went by special trolley cars from Boston to New London, Conn., last Saturday, en route to the Electric Railway Association convention at Atlantic City. Six cars of the Bay State Street Railway and the Boston & Worcester Street Railway conveyed the party by the two different routes.

Each car was equipped with electric cooking apparatus, to provide luncheon for the travelers. The object of the journey by this mode of travel was to demonstrate the practicability of long-distance touring by electric car.

From New London the party went by steamer to New York, and thence by railroad to Atlantic City. The trip was in charge of H. A. Faulkner, secretary of the New England Street Railway Club.

Lynn Section, American Institute of Electrical Engineers.

The Lynn Section of the Boston Branch of the American Institute of Electrical Engineers has laid out a program of meetings for 1913-1914 that promises much interest. A good beginning was made on October 8, when a large audience listened to a lecture on "Rapid Transit in Greater New York," by H. H. Barnes, Jr., district engineer of the New York office of the General Electric Company.

As arranged, on October 22, C. W. Stone, lighting department manager of the General Electric Company, will discuss "Generation and Distribution of Electrical Energy by Public Utility Companies."

On November 5, David B. Rushmore, of the General Electric Company, will discuss "Some Phases of Power Transmission Work."

The program for subsequent meetings is as follows: November 19, W. Goodenough of the Stone & Webster Company, "The Hydroelectric Development at Keokuk; December 3, J. A. Orange of the Research Laboratory General Electric Company, "Gas-Filled Tungsten Lamps;" December 17, Prof. H. E. Clifford of Harvard University, "Sympathetic Vibrations, with Some Electrical Applications; January 7, 1914, E. E. F. Creighton, professor of Union College, "High-Frequency Phenomena, and the Protection of Electrical Apparatus;" February 4, W. B. Potter, General Electric Company, "Electrification of Railroads;" February 18, Prof. Elihu Thomson, "Color Photography;" March 4, Walter C. Fish, manager of the Lynn works, General Electric Company, will speak on a theme to be announced.

An active canvass has been made by the Membership Committee during the past few weeks, and there are now some 400 members. E. R. Berry is the chairman and John A. McManus, Jr., secretary. The annual banquet is set for January 24, to be held in Boston.

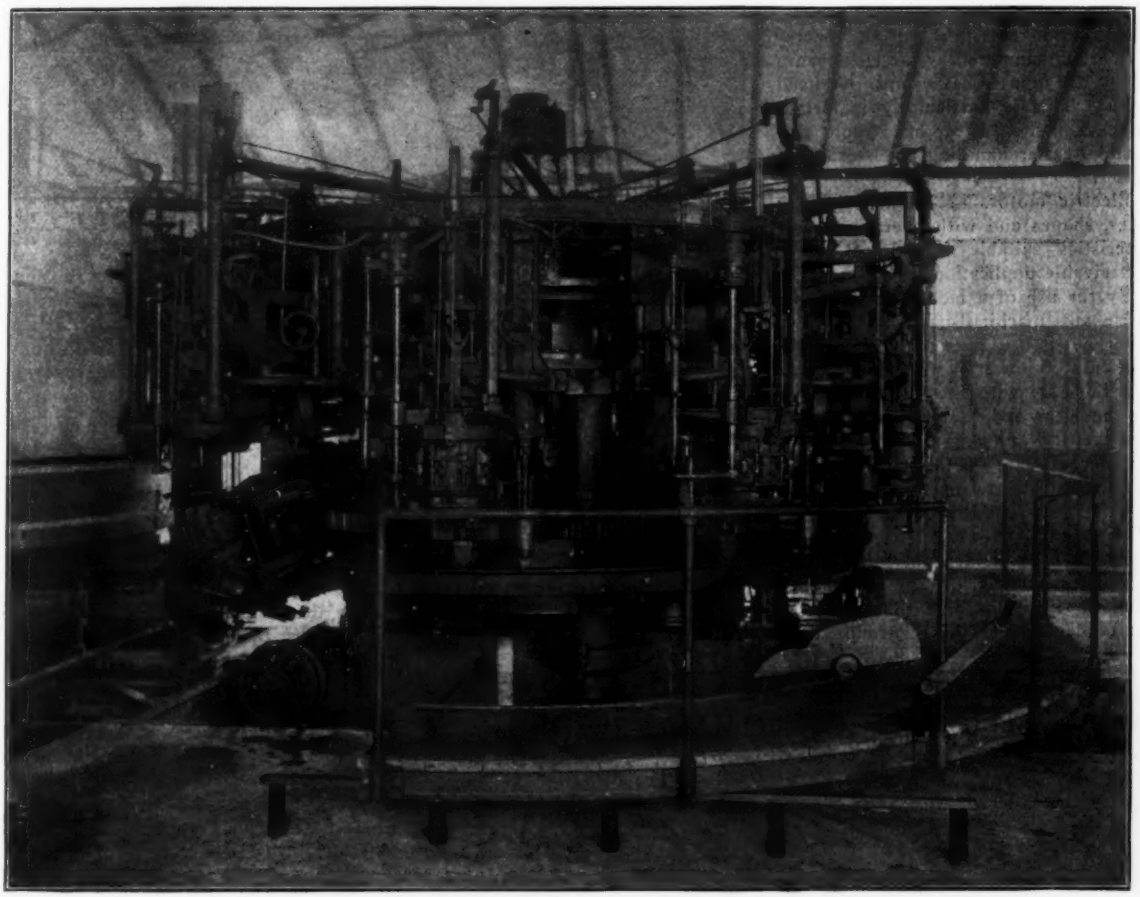
Water-Power Investigations in Massachusetts.

Investigation of the character and volume of the stream flow in the rivers of western Massachusetts is being conducted by engineers of the United States Geological Survey and of the State. The height of the streams and measurements of their discharge are taken at intervals, with the purpose of determining the volume of water. The data gained will be of value in the design, construction and maintenance of hydroelectric stations.

Electricity in Glass Plants.

The advantages of motor drive which apply specifically to glass manufacturing are discussed in this article, which also gives information relative to the machines employed and detailed data on several typical plants. Plate-glass plants are not considered in this article.

Electricity is being widely used in glass plants because of its inherent advantages over other methods of drive, and likewise, central-station service is superseding isolated plants because of its greater economy, absolute reliability and less attention required. In several glass manufacturing plants visited that had superseded isolated-plant operation with central-station service, the managers were enthusiastic over the greater economies effected and the generally improved operating conditions.



Owens Glass Molding and Blowing Machine Driven by a 7.5-Horsepower Motor. Ball Brothers Manufacturing Company.

It is hardly necessary to comment on the advantages of electric drive, as glass manufacturers generally recognize these. The important question is that of central-station service versus isolated-plant operation. However, a few of the more important advantages of motor drive that apply specifically to glass plants may be summarized as follows:

Industrial work generally requires the application of power at distributed points. No form of prime mover is available which can economically develop power in small quantities at the points of application. The electric motor furnishes the nearest approach to this condition in that electric energy can be economically transmitted and transferred into mechanical energy at the point of application in any quantity desired. When compared with line shafting and belts, the installation of wires for carrying electric current is a very simple and inexpensive operation; in comparing the relative losses in transmission the electrical losses seem almost insignificant.

With electric drive the location of buildings and of the individual machines in a shop is practically unhampered by considerations of power. Buildings can be placed with reference to good labor and transportation facilities, convenience with reference to each other, safety from fires or other disasters, etc., in any case electric energy is easily brought to the required location, the necessary wires being easily installed in space not valuable for other purposes. The machines in a plant can be placed so as to require minimum handling of material and to obtain most economical production; also, better light and ventilation can be given proper consideration. No matter how remote or inaccessible the corner in which the work is to be done, the motor-driven machine can fill the requirements.

The flexibility extends to the rearrangement of machines to conform to changing manufacturing requirements. A motor-driven machine can be moved from one location to another as a unit without disturbing or interrupting any

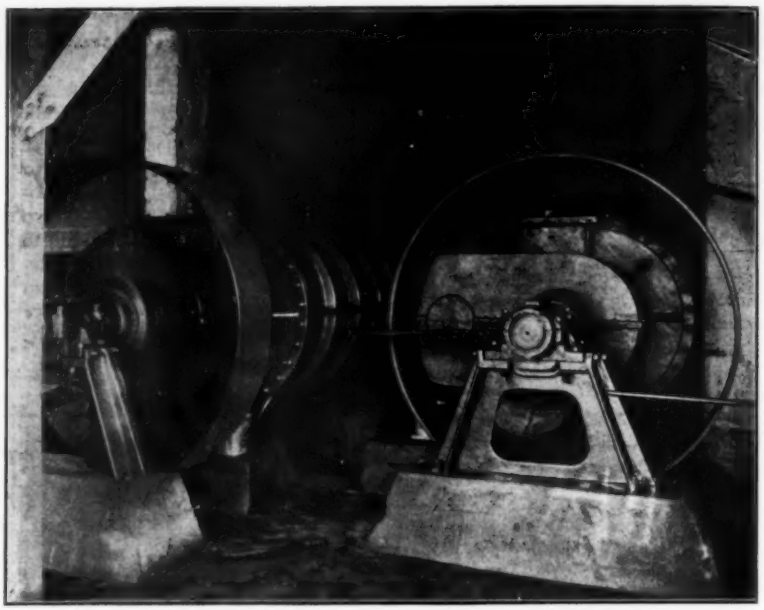
other machines. The only changes required on account of the power supply are the disconnection of the electric conductors in the old location and their reconnection after the machine is moved. This process is extremely simple compared with that of relocating line shafts and belts. The best arrangement for maximum productive economy can thus be maintained, under changing manufacturing conditions.

Additions to plants employing motor-driven machines and central-station service require very little consideration on account of power, other than the wiring.

With motor drive the machines become more accessible and the operators are unhampered by the close proximity of countershafts and overhead belts. This is particularly important in glass plants. Freer head room also permits easier handling and storage of material.

Electric motors are standardized in sizes, shapes and with operating characteristics suitable for almost every conceivable application.

By the use of a motor for each machine any machine can be shut down when not in use, thus stopping all wear and loss of power in friction. This is not the case with the line-shaft drive, as the wear and the friction losses in the shafting are only slightly less when all the belts are on their loose pulleys than when all the machines are working. This possibility of saving power with motor drive is an argument for the use of individual motors on the various machines or groups of machines. Each machine thus driven is an independent unit; group drive makes each group totally independent of all other groups. Hence in the case of over-time work, only the machinery required need be operated.



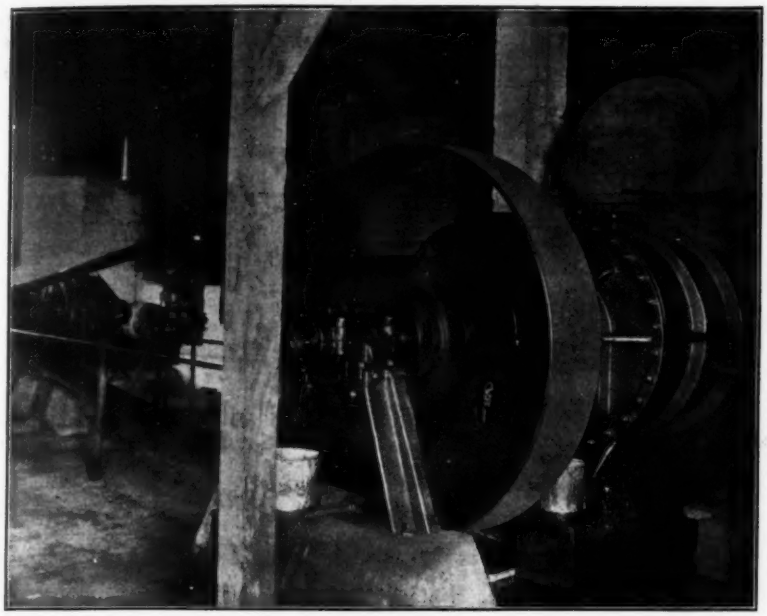
Motor-Driven Centrifugal Compressors.

Speed adjustment with motor drive is a simple matter, and a motor can be selected such that the speed at any adjustment will be practically constant at all loads. This feature enables a machine to be operated always at the most economical speed. A simple movement of a controller handle at any convenient point near or remote from the motor changes the speed instantly, and the number of possible speeds can be made as large as desired. Moreover, these conditions remain the same during years of service. With mechanical transmission the number of speeds is comparatively small and the speed increments large; moreover, the change of speed is troublesome, and workmen are often tempted to operate with uneconomical speed rather than change it.

A motor-driven machine consumes energy only while operating, and then only in proportion to the work done. Electric motors are very efficient machines in all sizes and at all loads within the ordinary working range, which is more than can be said of any small prime mover. The use of motors, moreover, eliminates some or all the losses due to friction of line shafts and belts. These losses consume anywhere from 30 to 60 per cent of the energy required to operate an ordinary shaft-driven shop or mill, and they are continuous, even though only a few of the machines are operating. Very few machines are in actual service more than half of the time, the cessation of all energy losses chargeable to each machine, except while it is in productive operation, constitutes a very large saving in power.

Of the plants now operating with mechanical transmission, the larger ones and those most complex or widely scattered would naturally derive the greatest benefit by adopting central-station power. In such plants, the transmission is usually more complicated, changing floor loads make it more difficult to keep shafting in line, while developing conditions make frequent modifications and extensions to the transmission equipment necessary. To save time and expense, these

Lehr Conveyor Driven by Two-Horsepower Motor.



50-Horsepower Motor Driving Centrifugal Air Compressor.

changes are often knowingly made, not in a manner to get the most economical results, but in a way that will do for the time and avoid interruptions to business. In a glass plant it is essential that things be kept moving, and frequently unfortunate compromises are made in the machinery arrangements to accomplish this end.

While the varieties of glass manufactured in this country are many, the processes involved are more or less similar, particularly from the power standpoint. "Batch" mixers, wherein the sand, soda ash and lime are mixed, are the first machines encountered. These are, however, usually elevated so that the batch can fall by gravity into the furnaces and, therefore, require elevators and conveyors for transporting the various ingredients. In some few plants automatic machines are employed for moulding and blowing the glass, but in the majority of instances no machines are employed. In one of the accompanying illustrations is shown an Owens machine for moulding and blowing glass fruit jars. These machines require approximately 7.5 horsepower. Conveyors and grinders of various types are used extensively in finishing work.

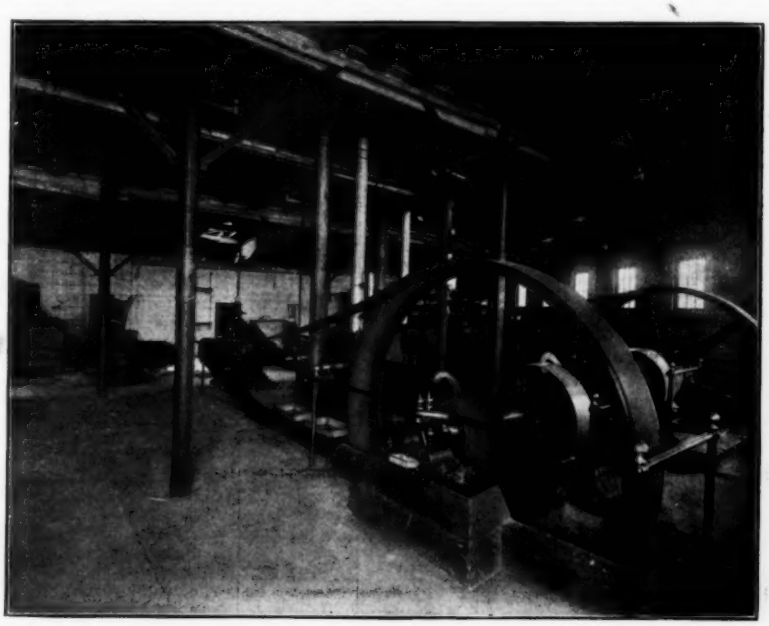
Of course, the most important feature of a glass plant is the furnace. The source of power that supplies air to the fuel is, therefore, deserving of the greatest consideration, particularly as the blowers require more power than all other machines combined. Centrifugal air compressors, consisting generally of one or more rotating impellers in series, taking air at atmospheric pressure and compressing it to pressures required for the service of the furnace, are now being widely adopted by glass manufacturers.

One of the important points in connection with this apparatus is the extreme steadiness of the blast. Another point which is of importance is the high efficiency of the centrifugal compressor, and the maintained efficiency after long periods of service. This efficiency is due to improvements made in the design of the apparatus, as compared with the centrifugal fans which have often been used for this purpose, and which are by comparison very wasteful in power consumed. In the case of the centrifugal compressor, the velocity impressed on the air by the movements of the impeller, is changed into pressure by the gradual slowing down of the air; and the fundamental principle which is responsible for this improvement in efficiency, and which has been observed, is that the slowing down of the air must be done in a perfectly definite manner, and without the production of any eddies.

Data on the horsepower requirements of the machines used in glass manufacturing will be found in the accompanying sheets giving detail motor data on several typical plants.

Street Lighting in Louisville.

Work has begun on the construction of the new system of boulevard lighting in Louisville, Ky. The contract for the installation of the system was made by the Board of Park Commissioners with the Louisville Gas & Electric Company. The company is to erect and maintain the system at the rate of $39 par lamp per year. There are 81 lamps placed 200 feet apart. Each standard is to carry a 100-candlepower lamp, inclosed in a 12-inch Alba glass globe. The lighting company is presenting to the Board two handsome standards, carrying three globes each, these to be erected at the entrance of Cherokee Park. The system now being installed runs from this point three miles west along Eastern Parkway to Southern Boulevard. It is expected that following the installation of the system the gasoline lighting system now used on most of the park roads will be replaced with electric lighting. The wiring for the new system is to be underground, special cables being provided for that purpose. Chief Engineer Wilbur Hubley is in charge of the construction work.



Motor-Driven Vacuum Pumps in Glass Plant.

Glass Factory Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Glass factory manufacturing several varieties of pressed and blown glassware, such as punch bowls, sugar bowls, water bottles, cracker jars and various grades of glasses and tumblers. There are two plants; one employing a 30-ton regenerative type of furnace and the other being of the crucible type in which a total of 30 crucibles are installed; 15 being in each of the two stacks. Most of the heavy pressed ware is made in a crucible furnace, while the thin-blown and lighter-pressed wares are made in the regenerative plant. There are 600 men and girls employed in two shifts in the magazine room, furnaces, finishing rooms, decorative departments, cooper shop, grinding room, etc. The day shift works from 7 a. m. to 5 p. m., while the night shift is from 6 p. m. to 4:30 a. m. Natural gas is used throughout for fuel, the 24-hour consumption being about 1,500,000 cubic feet. The weekly output of the entire plant is 285,000 pounds of finished product, this being about 60 per cent of the batch molded in the same period.

Total connected horsepower, 325. Total number of motors installed, 24. Average kilowatt-hours per month, 52,695.

Kilowatt-hour consumption for 12 months:

Month.	Kilowatt-hours.	Month.	Kilowatt-hours.	Month.	Kilowatt-hours.
January	5,420	May	45,300	September	65,260
February	40,060	June	58,850	October	70,370
March	45,080	July	48,440	November	68,000
April	50,930	August	66,630	December	67,900

Load-factor, 32.2 per cent.

The electrical energy consumption per ton of glass manufactured is 97.5 kilowatt-hours.

Motor Installation.

The following is a list of the motors installed with their respective drives. The supply is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Type.	Application.
1	2	1,120	Squirrel cage	Belted to an eight-foot shaft (two hangers) and a four-foot countershaft (two hangers) driving one Schmidt batch mixer and an 8-inch-by-35-foot bucket elevator.
1	2	1,120	Squirrel cage	Belted to a short countershaft and gear reduction to an 8-inch-by-36-foot bucket elevator for elevating "batch" to a storage cylinder.
3	2	1,710	Squirrel cage	Each belted to gear reduction on a "glazer" which consists of a 10-foot endless chain conveyor to carry glasses through a furnace to round off the mouths and the mold marks. Conveyor moves about eight feet per minute.
1	15	850	Squirrel cage	Geared to driving mechanism of a C. W. Smith five-ton elevator which serves two floors, speed 40 feet per minute.
1	2	1,710	Squirrel cage	Belted to a three-foot shaft (two hangers) and 41 feet of countershafting (12 hangers) driving seven lehrs, each approximately 45 feet long by 5 feet wide. A temperature averaging 890 degrees Fahrenheit is maintained in these lehrs.
1	30	1,120	Squirrel cage	Belted to an eight-foot shaft (two hangers) and 215 feet of countershafting (44 hangers) driving five grinding machines each having four revolving spindles 1,500 revolutions per minute, 10-inch-by-4.75-inch pulley, 930 revolutions per minute; two lathes for trueing grinder stones; one Rochester glazing machine which consists of a revolving disk carrying 24 spindles (disk makes one turn in approximately 45 seconds through a furnace supplying a fixed temperature); four crank "offs" for trimming off tops of blown glasses, 14-inch pulley, 120 revolutions per minute; one small air compressor; one 20-inch exhaust fan in decorating department; two vertical winches for hauling trays of glassware in the decorating department; one 110-foot long lehr for burning decorated ware; one 24-inch-diameter-by-one-inch hand wheel; one Sommerfield grinder 50-inch-diameter-by-four-inch stone mounted on a vertical shaft, stone turns 159 revolutions per minute, 18-inch-by-4-inch driven pulley.
1	2	1,700	Squirrel cage	Belted to a four-foot shaft (two hangers) driving a small paint grinder and a centrifugal gold mixer (additional load is contemplated for this motor).
1	100	1,150	Squirrel cage	Belted to a B. F. Sturdevant 80-inch rolling mill blower. (Has double intake and speed is 1,005 revolutions per minuate); motor pulley, 18-inch diameter by 12-inch; blower pulley, 22-inch diameter by 12-inch. Furnishes high pressure blast to the presses, working ovens, etc., in the regenerative furnace plant only.
1	15	1,135	Slip ring	Belted direct to a B. F. Sturtevant No. 9 multivane low-pressure blower having a single intake and speed of 460 revolutions per minute, motor pulley, seven-inch diameter by six-inch face, blower pulley, 18-inch diameter by six-inch face. Furnishes low-pressure draft to lehr, etc., in this plant.
1	15	820	Squirrel cage	Geared to driving mechanism of a C. W. Smith five-ton freight elevator serving three departments—decorating, finishing and shipping.

Glass Factory Data—Sheet No. 2.

No.	Horse-power	Speed R. P. M.	Type	Application.
1	10	1,710	Slip ring	Belted to a 10-foot shaft (two hangers) and 30 feet of countershafting (20 hangers) driving two Putnam revolving chucks for cleaning moulds; one Oliver 24-inch pattern lathe; one Joseph Colliday 36-inch by 25-inch band saw; one G. & E. Eberhardt 24-inch shaper; one 12-inch power hack saw; one J. G. Blount No. 494 carborundum wheel, 24-inch diameter; one 14-inch shaper; one American 24-inch engine lathe; one Hendly 16-inch engine lathe; one Cincinnati Pulley Machine Company "Avey" 12-inch drill; one W. F. & J. Barnes 28-inch drill.
1	2	1,120	Squirrel cage	Belted to a 12-foot shaft (three hangers) and 35-foot countershaft (four hangers) driving one E. & B. Holmes barrel tresser (requiring two belts, one having a half turn); one 24-inch-by-three-inch grindstone; one E. & B. Holmes No. 59½ raising and windlassing machine; two driven pulleys; one 20-inch-by-4.5-inch and one 18-inch-by-4.5-inch (one-half turn belt). Each pulley operates a friction drive.
1	5	1,800	Slip ring	Belted to a five-foot shaft (three hangers) driving the press, head transfer and blower of an E. & B. Holmes "Ideal" heading and hooping machine. The cooper shop has a daily capacity of 600 barrels when six men are employed.
1	50	1,140	Squirrel cage	Belted direct to a B. F. Sturtevant No. 9 Monogram high-pressure blower; motor pulley, 13-inch diameter by 11-inch face; blower pulley, 12-inch diameter by 10-inch face. Furnishes all blast to this plant.
1	5	1,130	Squirrel cage	Belted to a five-foot shaft (two hangers) and 86 feet of countershafting (12 hangers) driving ten lehrs. The shaft across the front of each set of five lehrs makes one turn in approximately ten seconds, which time suffices to draw the lehrs the length of one lehr pan.
1	30	1,130	Squirrel cage	Belted to a five-foot shaft (two hangers) and 92 feet of countershafting (23 hangers) driving one 15-inch diameter by 0.5-inch hand wheel; two Sommerfield grinders, 50-inch diameter by four-inch thick stones, each mounted on a vertical shaft; one 16-inch diameter by 0.5-inch grindstone; one 15-inch diameter by 2.5-inch hand wheel (grinding done in flat surface); one 30-inch-by-two-inch hand wheel; one Buffalo 20-inch forge blower (supplies draft to a forge in adjacent boiler room); three stopper machines for grinding stoppers to the desired fit; one cork stopper polisher; one 22-inch-by-1.5-inch grinding and cutting stone; one 36-inch diameter iron-plate grinder mounted on vertical shaft; two revolving chucks for dressing or polishing moulds.
1	5	850	Squirrel cage	Belted to operating mechanism of a Houghton 2,500-pound freight elevator serving three floors.
1	5	1,700	Squirrel cage	Belted to a three-foot shaft (two hangers) and a 20-foot countershaft (three hangers) driving one George W. Fifield 20-inch engine lathe; one Putnam 24-inch engine lathe; one John Steptoe 14-inch shaper; one Lodge & Davis 26-inch shaper; one 20-inch pattern lathe; one Currier & Snyder 24-inch drill; one double carborundum wheel, 13-inch-diameter by three-inch face.
1	10	1,140	Slip ring	Geared to a Sandusky Foundry & Machine Company five-inch-by-four-inch triplex plunger pump to furnish 100 pounds pressure to a hydraulic elevator.
2	2	1,700	Squirrel cage	Each belted to a 48-foot shaft (two hangers) driving a Sandusky Foundry & Machine Company 3.5-inch-by-three-inch triplex plunger pump, 76 strokes per minute. The plunger pumps are 21 feet below ground level and the water is 15 to 20 feet below ground level. One pump discharges against a 75-foot head into a storage tank while the other pump discharges direct to the mains throughout both plants.

Glass plant manufacturing a large variety of cut-glass work buying glass in the molded condition and doing cutting work only; 243 men and 15 girls employed working 10 hours a day.

Total connected horsepower, 15. One direct-current shunt-wound motor is installed. Average kilowatt-hours per month, 1,176.

Kilowatt-hours consumption for 12 months:

Month.	Kilowatt-hours.	Month.	Kilowatt-hours.	Month.	Kilowatt-hours.
May	1,425	September	1,517	January	808
June	1,274	October	1,532	February	922
July	822	November	1,400	March	840
August	1,599	December	1,122	April	853

Load-factor, 14 per cent; operating-time load-factor, 30 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 220 volts direct current.

Glass Factory Data—Sheet No. 3.

No.	Horse-power.	Speed R. P. M.	Application.
1	15	1,200	Belted to three 100-foot shafts (12 hangers each) driving 80 grinding frames of various sizes, maximum wheels 24-inch diameter, 85 revolutions per minute (only 40 to 60 frames are in use); one Payne special 24-inch lathe for sharpening grindstones; one inside polishing lathe; one 24-inch exhaust fan for exhausting acid fumes.

Glass plant manufacturing glass tumblers, oil lamps, lamp chimneys, fancy dishes and cut-glass ware. Three glass furnaces are installed which melt from 540 to 580 tons of flint glass and 192 to 240 tons of lead and cut glass per month. There are 260 men employed, working in two nine-hour shifts per day.

Total connected horsepower, 148. Total number of motors installed, 9. Average kilowatt-hours per month, 14,299.

Kilowatt-hour consumption for 12 months:

Month.	Kilowatt-hours.	Month.	Kilowatt-hours.	Month.	Kilowatt-hours.
January	14,300	May	13,900	September	13,840
February	13,800	June	14,760	October	13,370
March	15,141	July	14,000	November	15,000
April	13,800	August	15,320	December	14,300

Load-factor, 18 per cent.

The electrical energy consumption per ton of glass moulded is 18.7 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is two-phase, 60 cycles, 220 volts. All motors installed are of the squirrel-cage induction type.

No.	Horse-power.	Speed R. P. M.	Application.
1	75	690	Belted to a B. F. Sturtevant No. 10 Monogram blower, 1,175 revolutions per minute.
1	3	1,720	Geared to a Hill 4.5-inch-by-16-inch plunger pump; total head, 113 feet.
1	5	1,720	Belted to a Marshall 1,500-pound freight elevator.
1	5	1,720	Belted to a three-foot two-hanger shaft driving one 40-bushel lime mixer; one 30-foot bucket conveyor.
1	5	1,720	Belted to two 30-foot shafts (five hangers each) and one 12-foot countershaft (three hangers) driving 14 Lehr four-foot-by-50-foot baking oven rolls.
1	10	1,120	Belted to a 75-foot shaft (ten hangers) and two two-hanger shafts driving one four-inch paint mixer; one 24-inch grindstone; 13 glass grinders; and one four-foot disk grinder.
1	15	1,120	Belted to a 20-foot shaft (five hangers) and a 15-foot countershaft (three hangers) driving four vertical four-foot grinding mills; and four 22-inch mould cleaners.
1	10	840	Belted to a 75-foot shaft (12 hangers) driving 53 grinding machines; and one 30-inch exhaust fan.
1	20	1,120	Belted to a 60-foot shaft (nine hangers) driving one 30-inch drill; one 16-inch drill; two eight-inch drills; one 30-inch emery wheel; one 18-inch emery wheel; one double-disk emery wheel, (eight-inch and 18-inch wheels); one double-disk emery wheel, (12-inch and 18-inch wheels); four 22-inch-by-six-foot lathes; one 18-inch-by-four-foot lathe; one 16-inch-by-four-foot lathe; one 16-inch-by-four-foot pattern lathe; one 24-inch shaper; one eight-inch jig saw; one 14-inch shaper; one six-inch hack saw; one Adams 24-inch revolving head planer; one 24-inch forge blower; one 22-inch mould cleaner; one Marshall 800-pound elevator; one eight-inch-by-six-inch air pump; one flexible arm polishing brush.

Glass company manufacturing glass novelties, lamp chimneys, bowls, etc. Plant operates 10 hours per day.

Total connected horsepower, 53.5. Total number of motors installed, 7. Average kilowatt-hours per month, 11,105.

Kilowatt-hour consumption for 12 months:

Month.	Kilowatt-hours.	Month.	Kilowatt-hours.	Month.	Kilowatt-hours.
December	725	April	10,496	August	14,363
January	9,658	May	9,312	September	14,656
February	10,344	June	12,160	October	14,000
March	10,824	July	12,480	November	14,250

Load-factor, 39 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
2	10	1,200	Each belted direct to a 36-inch fan.
1	15	1,800	Belted to a line shaft driving a battery of five grinders, two 54 inches diameter, and three 44 inches diameter.
1	7.5	1,200	Belted to line shafting driving machine-shop equipment.
1	5	1,800	Belted direct to 90-inch fan.
1	3	1,800	Belted direct to No. 5 Buffalo blower.
1	3	1,800	Geared to deep-well pump.

Commercial Practice
Management, Rates, New Business

THE DETERMINATION OF OPERATING COSTS OF POWER INSTALLATIONS.[1]

By C. A. Fees.

It is the purpose of this article to give some of the methods by which the central-station's engineering department is enabled to determine the power costs of a private plant, when operating on its own power, and also the same costs when energy is purchased. The latter consideration also carries with it the engineering studies and tests required to plan the most economical layout, to the end that the power consumption and maximum demand of the system be reduced to a minimum. This generally takes more time and painstaking effort on the part of the engineer than the former.

However, the determination of the true costs when the plant is privately operated is more important, since the prospective customer almost invariably has an exaggerated idea of the economy of his plant operation, and also wholly overlooks several items of cost chargeable to that operation. Therefore, the utmost care and consideration must be given to every item entering into the cost of power production. Each must be clearly accounted for and the reasonableness of the charge made plain to the customer. It is obvious that it would be useless to charge the plant with some expense if the owner refused to admit that it was legitimate.

For example, a prospective customer whose plant was being tested would allow no charge against power cost, due to loss of production of the manufactured product, from engine breakdowns. He maintains that the repairs to the engine covered all the loss as it was necessary to shut down the plant for repairs occasionally in any event, and that all the orders could be held up for a few days and no business would be lost.

That he was wrong in his contention there can be no question. Part of the help were idle and production was cut down. The necessary repairs could have been made on Sunday as they are in most other plants. However, it was not possible to use this legitimate charge against his cost of operation and it was not included in the report of his plant.

Fortunately not all business men are as unreasonable as this, but the illustration shows the necessity of explaining in detail each item of expense charged to the plant.

In the average private plant, there are at least twelve different charges which go to make up the operating expenses, as follows:

(1) Labor; (2) fuel, including ash removal; (3) water; (4) repairs to all equipment, including cleaning of boilers; (5) miscellaneous supplies, oil, waste, packing, etc.; (6) value of time lost due to engine failure; (7) breakdown service, if purchased; (8) interest on investment; (9) depreciation; (10) insurance and taxes; (11) rental value of plant space; and (12) superintendence.

These items about cover everything, but they may be subdivided in any way desired. The National Electric Light Association has a form in which the charges are split up into 35 or 40 items under two headings, "Operating Expenses" and "Fixed Charges," and are arranged to show the isolated-plant cost and cost with central-station service in two parallel columns. This makes a balance sheet which shows at a glance the saving to be made by purchased power. It is good practice to use one of these forms in a preliminary estimate and then in the final report make a new balance sheet using only the items applicable to the plant in question. The use of the printed form acts as a reminder so that no charges are overlooked.

In general, when a new power customer is to be secured, an investigation of his plant is first made and a report showing the results obtained is submitted to him. A test is run to determine the power consumption and its cost of production. The engine is indicated at short intervals for the period of a full day run. The coal is weighed and the amount of oil, waste, etc., used is determined as nearly as possible.

Usually, however, these supplies, which together with repairs, labor, and water constitute the first five items in the previously enumerated list, can best be secured from the books of the company, and should if possible cover a period of a year or more. The number of hours the plant operated and the amount of finished product manufactured for the period should be obtained. These serve as a check on the values found during the test. If the test shows a greater production per unit of fuel consumed than the yearly figures indicate, plant conditions should be carefuly scrutinized before accepting the test results as final.

Item number six, the value of time lost due to engine trouble, is one that usually has to be assumed unless a record of shutdowns has been kept. If no records are kept, it is necessary to estimate the number and their duration. A very fair idea very often can be obtained from information secured from plant employees. The engineer, however, can seldom call to mind any shutdowns due to engine failure. Nevertheless, a great deal of useful data on this and other points can be picked up from the men. In an investigation of this kind, it is usually a good plan to visit around with them for several days or a week if necessary. It is surprising to note the insight into the workings of the plant that may be secured in this way. The average engineer or superintendent is not at all keen about disclosing the deficiencies and troubles of his plant and if questioned directly, will evade the issue if possible. Somewhat extended visiting, however, usually will bring out some very good points in favor of central-station power.

The fixed charges, interest, depreciation, insurance and taxes are easily shown to be legitimate charges against the power cost and the customer usually admits them very readily. The really difficult part is to show him that he saves these charges if he junks his plant and puts in central-station service. The average man dislikes to throw a good piece of machinery away and will think that the new equipment should bear the burden of the fixed charges on the old as well as its own, despite the fact that the old plant is valueless to him.

The mere fact that central-station power is available at a price equal to the cost of production in the private plant makes that private plant a useless appendage to the process of manufacture. The object of the plant is to manufacture flour or shoes, or biscuits as the case may be and not to make power, and if this object can be accomplished without a power plant, at an equal cost, then the plant, with its attendant risks of boiler explosion, etc., has no value and is at once depreciated 100 per cent less its sinking fund and sale value. The total remaining investment must be charged off to profit and loss or to whatever will least injure the feelings of the owner.

1 A paper presented before the Kansas Gas, Water, Electric Light and Street Railway Association, Hutchinson, Kans., October 9-11.

Number eleven in the list, the rental value of the plant space, is always determined by local conditions and may be of considerable importance if the factory has outgrown its ground space.

The last charge, that of superintendence, is one that is seldom considered by the owner. It is not usually large, but nevertheless is a real charge and should be taken into account when estimating isolated plant costs. It is the value of the time of the manager and foreman, or superintendent and the clerical force chargeable to plant operation. The plant requires constant attention from the various executives, which includes the hiring and discharging of employees and the supervision of the purchase of fuel and supplies. In addition, the accounting department must enter all these accounts in the books. Probably no salaries can be reduced, but the various employees will have more time for other duties and will be more valuable to the company. The owner can usually be shown that this is a proper charge.

The planning of the motor equipment calls for a good knowledge of mechanical engineering and considerable ingenuity is often required to determine the sizes of motors needed. If possible, the engine should be indicated when running without load, but with all shafts and belts to countershafts running. This will give the friction loss at no load. It should not be assumed, however, that this is the total loss under operating conditions. The full-load friction loss is much greater than the no load. This will be evident when it is considered that the belt tension must be greater to pull the load than when running light and consequently, the shafting all bears with greater pressure per square inch on each bearing.

In many cases, it is possible to determine the full-load loss to a fair degree of accuracy. Assume, for instance, a factory where the load is made up of a number of different machines belt driven from countershafts, such as a planing mill or machine shop. Assume a full load of 150 horsepower and a no-load friction loss of 45 horsepower. Now with full load on the shop, if each individual machine is in turn disconnected and a card taken with the one machine off, the difference between this indicated load and full load will be the power required to drive it.

The difference between the sum of the individual requirements of all the machines and the full load will be the friction loss at full load. This will invariably be found to be from 50 to 100 per cent greater than the no-load friction loss. In the case assumed it will probably be 75 horsepower or 50 per cent of the total power produced. In a year of 3,000 hours with full load, 75 per cent of the time and no load the remainder, the loss would amount to 202,500 horsepower-hours or 151,875 kilowatt-hours.

At two cents per kilowatt-hour this amounts to $3,037 per year. It will not be possible to save all of this loss except with individual motors on each machine. It may be found to be more desirable, on account of first cost to install group drive. Separate motors on each machine are correct when the cost of installation is less than for group drive, or when the saving in power consumption will pay for the excess cost of individual drive. Considerable care should be exercised in determining these details and in the selection of the proper size of motor. The motor efficiency is in favor of the large motor with group drive if fully loaded, otherwise, it is in favor of the full-loaded individual motor.

If possible, machines with the same load-factor should be grouped together. A test motor can be temporarily connected to each machine or group of machines and the load curve taken with a curve-drawing wattmeter. In this manner the load-factors of various machines is determined and the total kilowatt-hour consumption of the shop may be prejudiced very closely. It may be found that due to peculiar load conditions the load-factor with individual motors is so much lower that there can be no possibility of using group drive. This occurs in plants where a number of the machines are idle a greater part of the time. In one industry, group drive was decided upon and the machines in one room were driven by a 15-horsepower motor belted to the existing line shaft. The first cost of the installation was the deciding factor and the motor was put in without any tests of any kind. A test was then made and the following results obtained:

The line shaft was 75 feet long with 11 hangers, five countershafts, three crossed belts and two sets of cone drives for varying the speed of two machines. The belts on the cone drives frequently broke, putting about 15 operatives out of work, while the engineer repaired the damage.

The line shaft required 3,225 watts with no machines on, not counting the losses in the motor. With the full load the input was 9,300 watts, but the load-factor was poor. The largest machine operated but seven hours per day. The conveyor operated 9 hours per day and the other machines were used not more than two or three hours per day. The total consumption for the day was 83.7 kilowatt-hours. The full-load losses as nearly as could be determined were 4,200 watts, a comparatively small increase due to the fact that only one machine was used at a time. 5,200 watts was all that was actually required to run the large machine and the conveyor, which amounted to 30.4 kilowatt-hours for the seven hours. The actual power used in the other machines was as nearly as could be determined 9 kilowatt-hours, making a total of 45.4 kilowatt-hours useful energy consumed, while the lost power amounted to the difference between 83.7 kilowatt-hours and 43.4 kilowatt-hours, or 38.3 kilowatt-hours per day. At two cents per kilowatt-hour this amounts to 76.6 cents per day, or $233.63 per year of 305 days. Individual variable-speed motors could be supplied for $700 and would earn 33 per cent on the investment in the saving of friction losses alone, not counting the 10 per cent increase in production due to positive drive and elimination of belt troubles.

On the other hand, if the load-factor is high and the machines operate continuously at full load, it may be a better proposition to install one large motor in place of the engine and continue the old drive.

Take, for example, a flour mill that runs 24 hours per day. There are numerous machines in the cleaning department and in the upper stories above the rolls that take very little power to operate, but require hundreds of feet of shafting and belts to get the power to them. In an investigation recently conducted in a mill of this type, it was estimated that if individual motors were installed on the sifters, reels, purifiers, and dust collectors, 50 per cent of the power needed above the roll lines could be saved. Further investigation, however, showed the following: The efficiency of one large motor was 92 per cent. The efficiency of the small slow-speed motors necessary for direct connection was only 72 per cent. There was 22 per cent of the apparent saving gone in the motors. Fixed charges including a fair profit on the investment, over and above those chargeable to the big motor absorbed 33 per cent more. With the large number of motors, it would be necessary to have an electrician on the job. This took 23 per cent more, and miscellaneous items brought the saving down to $23 per month. This is a negligible amount in view of the bother incident to the starting of the large numbers of motors, the increase in insurance rates and the probable increase in repairs. The proper course in this instance was to continue the old drive with one large motor in place of the engine.

In making a preliminary estimate of motor requirements the following data have been found to be closely accurate.

The waste power consumed by bearings, pulleys and belt varies from 27 to 75 per cent and averages 50 per cent of the power generated. The friction of a shaft is about four horsepower per 100 feet. Two-bearing counter shafts consume 250 watts. The loss due to belt slippage varies from 6 to 30 per cent. The loss in universal joints is from 10 to 20 per cent. The loss in cross belts is usually from 20 to 30 per cent and may be greater.

The increase in production with mo-

tor drive is usually from 10 to 25 per cent with no greater power consumption and some times with less.

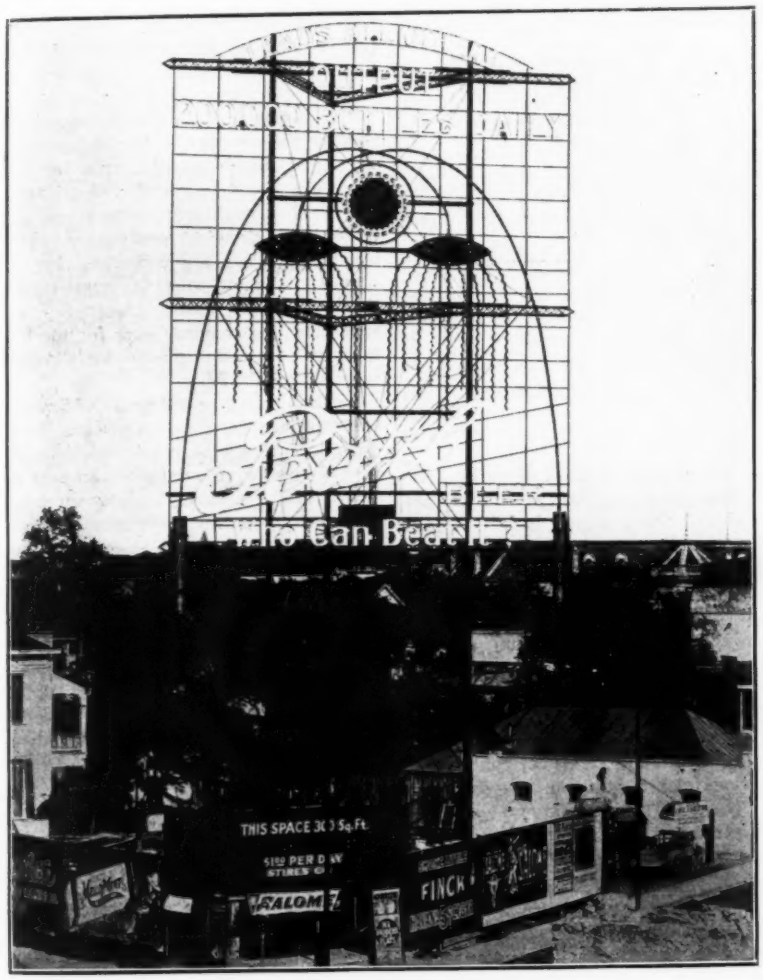
One more point in determining the costs is most important. In carrying on these investigations, the central-station engineer should make not only a study of the electrical essentials for purchased power, but also should go into the customer's processes of manufacture, with the idea of correcting any operating mistakes that he may find.

Report on New York Signs.

A special commission appointed by the late Mayor Gaynor, of New York City, to study the billboard problem, has published a report comprising a book of over 150 pages. Among other things the Commission recommends that health officials be authorized to prohibit large electric signs where they are found to interfere with sleep in residential districts and that both health and fire officials be authorized to order the removal of all signs which are a menace to health and safety.

Immense Electric Sign for the San Antonio Brewing Association.

In the center of the City of San Antonio, and commanding its busiest thoroughfares, stands what is in all probability the largest electric sign, in point of dimensions, in the world. Standing on three immense steel towers, over 125 feet in height, and built from the ground up, is a framework over 60 feet in width, which carries what is said to be as beautiful a spectacular electrical display as has ever been constructed for the South. The reading matter on the sign recites the fact that "Leading all others, with an output of over 200,000 bottles daily, Pearl Beer cannot be beaten."



Monster Sign for San Antonio Brewing Association.

The display consists of a pair of gigantic sky-rockets, which shoot up on either side, arching gracefully to the center of sign, cross and burst, with varicolored showers dropping a distance of 38 feet, and gradually dying out in luster until they disappear completely. The large seal which is a replica of the Pearl Beer trademark, meanwhile scintillates and glows as if alive, it appearing in the form of a large brooch studded with pearls.

Figures are not always dry, nor facts uninteresting. Beginning with the angle irons used in the construction of the sign, let it be said that, if placed end to end, they would reach a distance equivalent to one mile and would require a freight car to transport them. The galvanized sheet metal used in constructing the face of the sign aggregates over 6,000 square feet, and if cut into strips 0.5-inch wide, placed end to end would reach nearly 28 miles. Made into roofs, this amount would be ample for sheltering 1,500 people comfortably. The time required to make this sign, if done by a single average workman working eight hours per day, would total 294 days, or practically a full working year.

The approximate condlepower of the sign is 12,368, there being 3,092 P. & S. receptacles required to thoroughly illuminate all of the letters and parts, and Mazda lamps of four candlepower being used. To haul the lamps to the sign took two trips of a large two-horse truck and to screw them in place took two men the best part of two days, exclusive of placing the 1,775 Betts & Betts color caps, which required nearly two more days time for an apprentice. The receptacles alone amount to a large truck load, and, if placed six inches apart in a straight line, would make nearly a third of a mile.

The sign contains over two miles of wires of various sizes, the necessary connection requiring over 8,200 separate soldered, taped and sealed joints. A total of 12 Hawthorne, low-voltage sign transformers are used, there being five 2,000-watt, two 1,500-watt, one 1,000-watt and four 500-watt sizes. These are mounted on the rear of frame in such relation to the flashing mechanism as to decrease the amount of voltage drop and amount of copper necessary as much as possible.

The quadruple-deck flasher, furnished by Betts & Betts, stands over six feet long and four feet high, its cams operating at four different speeds; besides this is a specially constructed dimming apparatus for the star showers which ingeniously decreases their candlepower until cut out entirely. The flasher weighs over 1,000 pounds, and every one of the 118 connections is properly fused where entering flasher.

Let it be said that to the great credit of the manufacturers, the Greenwood Advertising Company, of Knoxville, Tenn., this sign was constructed and shipped complete, on the twenty-second working day after placing order in the factory, and that an entirely strange set of mechanics erected and connected same without a single hitch, from the complete information and detailed drawings furnished by the makers.

House-Wiring Campaign at Rockford.

The Rockford Electric Company, Rockford, Ill., has recently conducted a house-wiring campaign that was productive of very gratifying results. Of a total of 1,000 houses available, over 200 were wired during the campaign. A. C. Martin, new business manager of the company states that this business in all probability could not have been secured in the regular way. The housewives of Rockford, as in every other American city, appreciate a bargain and the special rates offered by the company during this campaign did much to influence the securing of contracts.

The details of the campaign are worthy of mention. Supplementing newspaper space, a series of three personal letters was sent to each prospect, the first written by the new-business manager, the second by the general manager, and the third by the new-business manager. The company's solicitors compiled the list of 1,000 names of owners of unwired houses from a personal canvass of the city.

The first letter was destined simply to create curiosity in the campaign and gave no details of the plan. The letter was as follows:

Dear Sir: This year will be Rockford's biggest building year, every house built will be modern and wired for electricity—why not put your house on a par with these new houses and wire it before your wife does her spring housecleaning?

We had a great deal of experience in having old houses wired last year and we mean to give you the benefit of our experience, we can offer you, for a limited time, a wiring proposition that will actually surprise you when you know the small amount it will cost to equip your house.

We want very much to interest you before house cleaning time and will appreciate it if you will mail us the enclosed post card; this will not obligate you in any way but gives us an opportunity to present our proposition to you.

Following this letter, a second one, written by the general manager, was sent to each of the 1,000 prospects. This letter, which is reproduced herewith, indicated the opportunity that was being presented to have houses wired at a low cost and invited prospects to arrange for a visit of the company's representative.

At my suggestion our Mr. Martin wrote you about wiring your house and in looking over the copy of his letter I find he has failed to tell you about our agreement with the contractors whereby we agree to have 100 houses wired and in consequence they give us a ridiculously low price.

I have instructed Mr. Martin to write you in detail regarding our plan of wiring old houses and, as I believe he has my idea now, he will give you some interesting facts and figures about the cost of wiring your house.

If you would care to take this up personally I will be pleased to send a competent representative if you will mail me the post card sent you with Mr. Martin's letter.

The final letter which was written by the new-business manager was sent to all who had not replied to the two previous communications.

Mr. Golding wants me to tell you of our house-wiring proposition and to tell you in plain facts and figures.

We do not do wiring ourselves but have the different contractors in town take care of all our work. This winter I have been figuring with these contractors and believe I now have quoted me the most satisfactory price for wiring one hundred houses complete with fixtures that has ever been known in Rockford.

To enable you to wire now and take advantage of this 100-house offer, we are arranging to carry the accounts for one year and allowing the home owner to pay for the wiring along with his electric bills each month.

The figures we now have include a light in every room in your house with a beautiful fixture. The dining room and living room have three-light showers with a side wall switch to control the light and the porch light also has a wall switch just inside the front door. The fixtures for the bed rooms are equipped with the convenient pull-chain sockets. In fact, your house will be wired complete and modern even to the smallest details.

If you want to take advantage of this 100-house offer we would be pleased to quote you 1913 prices and give you further details.

While this letter goes more into detail regarding the plan, no figures are given and the prospect is left to take up personally with the company's salesmen the cost, selection of fixtures, etc. It has been the experience of the Rockford company that better results can be obtained by leaving the final work to the salesmen than by presenting the proposition complete in letters or advertisements.

The company, in this campaign, had secured from the electrical contractors of Rockford a uniform low price on the basis that a stipulated number of contracts would be secured by the electric company without any cost to the contractors. While it was agreed that a standard set of fixtures was to be specified if certain low rates were accepted by the prospect, the contractor was enabled to deal directly with the customer and could supply any fixtures desired.

Steam-Heating System Extended in Louisville.

The Louisville, Ky., Gas & Electric Company is furnishing central-station steam-heating service from three plants located in the downtown district. They are the Fetter, Gaulbert and Campbell plants, and were formerly used by individual owners for furnishing electric light service in the blocks in which they were located. Steam-heating service has proven popular with owners of buildings in the same localities, and the plants are being operated principally for that purpose at present. It is expected that the company will make use of the franchise owned by the Fetter company later on for the purpose of extending the steam-heating system through a portion of the central business district.

House-Wiring Campaign in Manchester, N. H.

The Manchester (N. H.) Traction, Light & Power Company, which owns and operates the Manchester Street Railway, the Manchester and Derry Street Railway and the Manchester and Nashua Street Railway, besides doing a lighting and power business, is conducting a "free fixture campaign." During the month of October the company is furnishing house lighting fixtures free of charge for any home not already wired for electricity.

There is a working agreement with the three local electrical contractors under which the latter are authorized by the company to quote on wiring contracts on the free fixture basis. Under this arrangement the company pays for the fixtures and the customer pays for all other supplies and the labor.

Naturally the type and grade of fixtures are restricted in value. They are, however, no cast-offs, but modern and up-to-date fixtures. A sample assortment is shown in the company's show windows, but when requested the customer is allowed to make his own selection within certain price limits.

The offer applies only to houses built along the company's lines, and the right is reserved to withhold the proposition where the expense would be excessive by reason of unusual conditions. The special objective of the campaign is to bring about the wiring of older houses which otherwise might not be connected to the lighting circuits.

Rates for Street Lighting.

The Mayfield, Ky., Water & Light Company and the municipality have reached a compromise in regard to charges for maintaining electric lamps for street lighting. The city by ordinance reduced the charges from $96 to $72 a year, which the company resisted in court. Recently the charge of $84 was agreed on, the city paying at this rate for the term during which the question has been at issue.

White-Way Lamps in St. Louis.

During the past month the Union Electric Light & Power Company, of St. Louis, contracted for the installation of 302 additional "White-Way" lamps on various business streets.

Electrical Construction

INSTALLATION OF RIGID-CONDUIT WORK IN BUILDINGS OF CONCRETE CONSTRUCTION—II.

By G. N. McCarthy.

An excellent method of securing an outlet box in a form for concrete is indicated in Fig. 17. The box with the conduit running to it is nailed on the top of the form with a couple of spikes in exactly the position that it should occupy in the ceiling. The interior of the box is stuffed with paper to prevent the entrance of concrete around the edges. The concrete is then poured around the box and conduit and permitted to set. When the forms are removed, the spikes protrude into the box, and the paper remains in it.

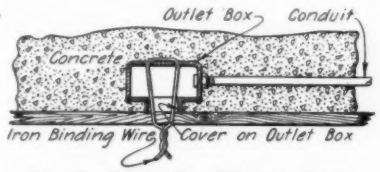


Fig. 15.—Outlet Box Wired to Form.

The spikes can be cut off with a pair of nippers. Boxes for use in ceilings in concrete buildings should be deep.

A method of holding an outlet box to the form with a pipe nipple is illustrated in Fig. 16. This method can often be effectively used where all outlet boxes are equipped with fixture studs. A hole of great enough diameter to admit a pipe nipple is bored in the form at the proper place. Then the box, with the nipple and coupling

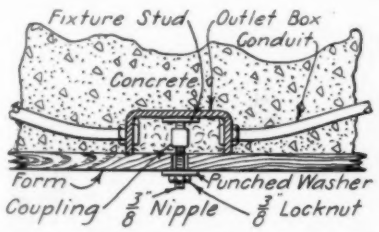


Fig. 16.—Outlet Box Held to Form with Nipple.

made up on the fixture stud, is put in position on the form, and the locknut screwed up against the punched washer. The conduits must, of course, be made up into the box before it is fastened on the form, and the box should also be filled with paper, to prevent the entrance of concrete, before it is fastened into position. This method is one of the neatest because when the

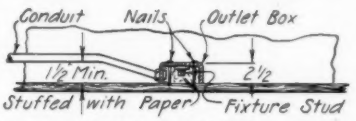


Fig. 17.—Outlet Box Nailed to Form.

form is taken down it is only necessary to unscrew the nipple and coupling from the fixture stud. There are no nails and wires, which are considered objectionable by some architects and contractors, extending into the box.

A method of securing an outlet box to a form with iron wire is illustrated in Fig. 15. Two holes are drilled for the wire through the form. A U-shaped piece of wire is then passed through the two holes in the back of the box, and through the corresponding two holes in the form. Twisting the binding wire draws the box snugly against the form. One disadvantage of this method is that it is difficult to effectively plug the holes in the box through which the wires pass, to prevent the entrance of concrete. This disadvantage can be offset by using stove bolts instead of the wire. It is believed, however, that as a general proposition, the method described elsewhere, of fastening the outlet boxes to the form with wire nails is, everything considered, the one to be preferred. Where either stove bolts or wire are used for holding the boxes to the form, the ends that protrude into the box, after the concrete is set and the form removed, can either be cut or broken off flush with the interior surface of the box.

Nails and wire for holding outlet boxes to forms should preferably be of the common iron variety, and ungalvanized. Where the ungalvanized material is used the action of the concrete mixture so corrodes it that any protruding ends can be easily broken from the interiors of the outlet boxes. Where the wire or nails are galvanized they are not so readily attacked by the concrete and it requires considerably more work to effect their removal from the outlet boxes after the forms have been taken down.

Outlets on concrete ceilings that are to be plastered can be arranged as indicated in Fig. 18. A shallow box, or as it is sometime called "a ceiling pan," one-half inch in depth is used. The pan is held to the ceiling by the conduits that enter it as shown in the illustration and the bottom of the box bears against the face of the ceiling. The box is so shallow that the plastering—a rough coat and a finishing coat

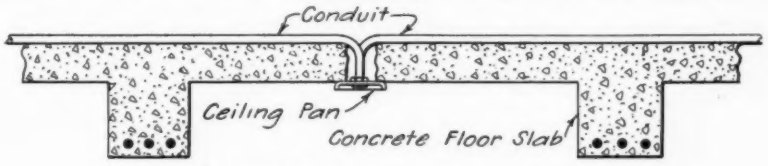


Fig. 18.—Shallow Outlet Box in Concrete Ceiling Before Plastering.

—can be easily made equal in thickness to the depth of the box. Therefore the lower edge of the box will lie flush with the surface of the plaster after the job is completed. If an electrolier is to be hung from the outlet, particularly if the electrolier is a heavy one, it is a good plan to provide a support for the box other than that given by the entering conduits. Several dependable methods of sustaining outlet boxes at electrolier outlets are described elsewhere in this article.

Another arrangement of an outlet

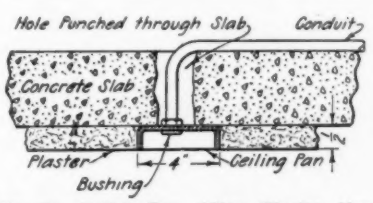


Fig. 19.—Outlet Box After Plaster Has Been Put on Ceiling.

box in a plastered concrete ceiling is illustrated in Fig. 20. The box is fastened in the form with its face against the upper side of the form. After the form has been removed, and before

the plastering is done, the wireman must place a face ring on the box as shown in Fig. 20. If the thickness of this ring is properly selected the plastering will come just flush with the outer edge of the ring.

Supporting Heavy Fixtures.

An arrangement where heavy fixtures must be supported from outlet boxes shown in Fig. 22. When the

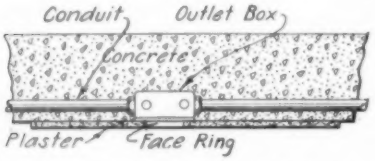


Fig. 20.—Plastered Concrete Ceiling.

fixtures are not heavy, a fixture stud screwed to the interior of the box as shown in Fig. 16 will often prove satisfactory, but where a large electrolier is to be installed, the better practice is to provide some sort of a crosshead to take the weight of the fixture. The device of Fig. 22 is a homemade arrangement and consists merely, as shown in Fig. 23, of a pipe tee, a

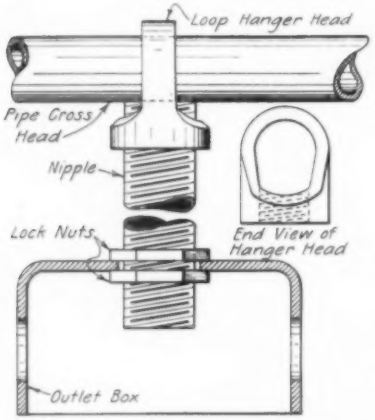


Fig. 21.—Hanger Arrangement for Fixture Outlet.

nipple, and a piece of iron rod or pipe, which forms the crosshead, fastened with a locknut. It will be noted that the nipple forms a stud for the support of the chandelier. The cross head piece

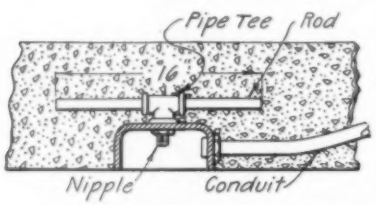


Fig. 22.—A Homemade Fixture-Outlet Hanger.

should be in the neighborhood of 16 inches long.

A commercial device, or hanger head, made for supporting electroliers from outlet boxes in terra-cotta or reinforced concrete floors, is shown in Fig. 21. The method of arranging the hanger head is evident from the illustration. The head is so proportioned that it will fit standard wrought-iron conduit and pipe. Where the floor is sufficiently thick, the nipple should be longer than indicated in Fig. 22, so that the crosshead will lie in the slab well towards its upper surface.

Outlet hangers should be assembled in the shop complete so that they can be attached to the outlet box on the job with the minimum of labor. It has been found unsatisfactory to endeavor to assemble them on the job, because of the readiness with which the small parts are lost. In installing a box equipped with a hanger, the box is fastened to the concrete form in the usual way, and the hanger set up in it. Then, the concrete is poured around the whole arrangement and lightly tamped into place.

In holding conduit to a concrete surface with pipe straps, the usual method is to apply the lead expansion shields which are readily obtainable from

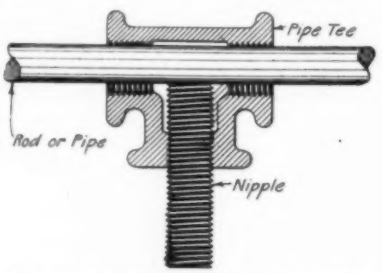


Fig. 23.—Clamping Effect of the Home-Made Hanger.

hardware dealers. The expansion shields, which can be secured for wood screws of practically any length and diameter, are set in holes, drilled in the concrete. The drilling should be performed with an electric or pneumatic drill, where such are available, because of the economy resulting from their use. Wood screws turning through the pipe-strap holes into the lead shields imbedded in the concrete, support the conduit in position.

A scheme for supporting pipe straps to a concrete surface that can be used where it is impossible to secure the commercial lead shields, is illustrated in Fig. 25. A hole of a diameter equal to about three times the diameter of the screw to be used, is drilled in the concrete. A stove bolt of a size that will go through the pipe-strap hole is then wrapped with a piece of solder wire, as suggested under "Details," in Fig. 25. This stove bolt with solder wire wrapping is now inserted into the hole drilled in the concrete, and the solder wire is pounded into a compact mass around the stove bolt with a pounding tube as indicated. This pounding tube consists merely of a piece of iron pipe or brass tube, that will readily pass over the screw and into the hole.

Two screws like that illustrated in Fig. 25 are required for each pipe strap, but if a pipe saddle (Fig. 26) is used, one bolt is sufficient. A nut turns on the stove bolt and against the pipe saddle. Any length of the bolt

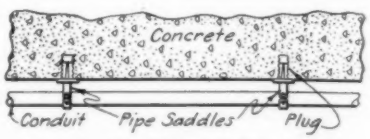


Fig. 24.—Installation of Pipe Saddles.

that extends beyond the nut can be cut off with a bolt cutter.

Use of Pipe Saddles.

Pipe saddles can be effectively used for supporting conduit on concrete surfaces. The pipe saddle (Fig. 26) is a fitting which can be purchased from any dealer in plumbers' supplies, and consists of two malleable-iron castings, one of which is held to the sup-

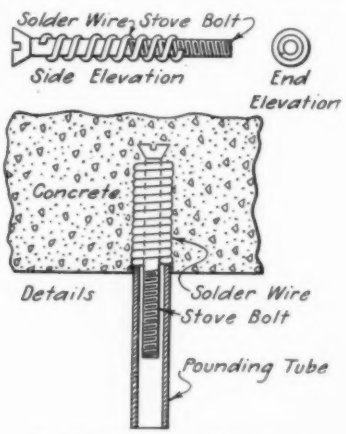


Fig. 25.—The Solder-Wire Plug.

porting surface with one bolt. Two machine screws hold the yoke of the saddle to the base. An advantage of this fitting over ordinary pipe strap is that it requires but one bolt to secure it to the surface. With ordinary pipe

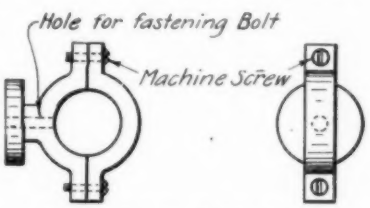


Fig. 26.—Details of Pipe Saddle.

straps the screw holes are so small that small-diameter screws must be used, which do not always hold well in the lead anchors. But the pipe saddle

gives substantial support. However, the principal advantage is the fact that one bolt is used with the saddle, where two are required with the pipe strap. one large screw can be used, which The use of but one bolt involves the drilling of only one hole. Where two holes are drilled for a pipe strap, the concrete between them sometimes breaks out, particularly where the slab is weak or honey-combed. The pipe saddle holds the conduit away from the supporting surface, whereas the pipe strap holds it against the surface. This feature might, in some cases, be a disadvantage.

(To be continued.)

Among the Contractors.

J. L. Burgard, of Chicago, is wiring a large building at 6410 Jefferson Avenue, this city.

J. P. Kerns, of Chicago, has the contract to install about 600 incandescent lamps in a building on West End Avenue.

L. N. Kathan & Company, who recently established an electrical contracting, supply and fixture business in Schenectady, N. Y., have recently moved into more centrally located quarters at 236 South Center Street.

Merton S. Harter, electrical contractor of Herkimer, N. Y., has the contract for the wiring in the new Hines Theater Building now nearing completion.

The Turner Electric Company, of Elmira, N. Y., has the contract for the complete electrical installation on the building of the new Elmira *Herald*. The company has also just completed the installation of a 200-kilowatt rotary convertor in the plant of the American La France Fire Engine Company, in Elmira. This included transformers, oil switch, meter boards and station panel.

NePage, McKenny & Company, electrical engineers and contractors, with offices in Victoria and Vancouver, B. C., and Seattle, Portland and Spokane, have been awarded the contract for the complete electrical installation in the new Pantages Theater being erected for Alex Pantages, in Victoria, B. C., the contract amounting to approximately $8,000. Jesse M. Warren, Central Building, Victoria, B. C., is architect.

ELECTRIC POWER ON A DREDGER.

By Richard E. Smith.

When the city of San Diego undertook to reclaim a large area of tide lands lying between the business district and the deep waters of the harbor, one of the most important problems presented was that of dredging. The work of reclamation is being accomplished by building a bulkhead about 600 feet from the old shore line; the area in front of this bulkhead is being dredged and the mud dumped back of the bulkhead, thus building up the old mud flats to the street level.

The City Council considered all bids offered by the regular dredging outfits excessive and set about to do the work with a municipal dredger. To this end a dredger having a fourteen-inch discharge was built. This machine, which is operated by gasoline engines, has been in service for nearly a year and is doing the work for six cents per cubic yard, a big saving on the lowest bids offered.

When the success of the venture was assured, the Council decided to build a

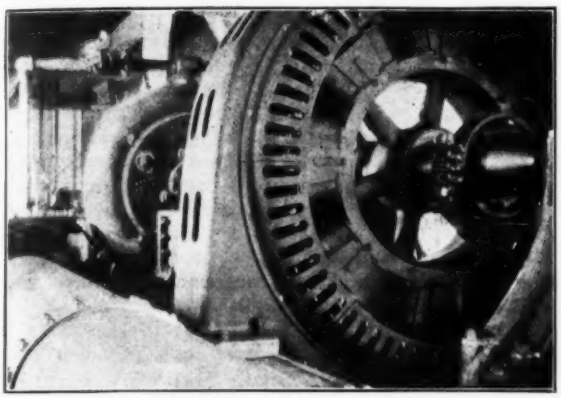


Fig. 1.—600-Horsepower Synchronous Motor Direct-Connected to 18-Inch Pump.

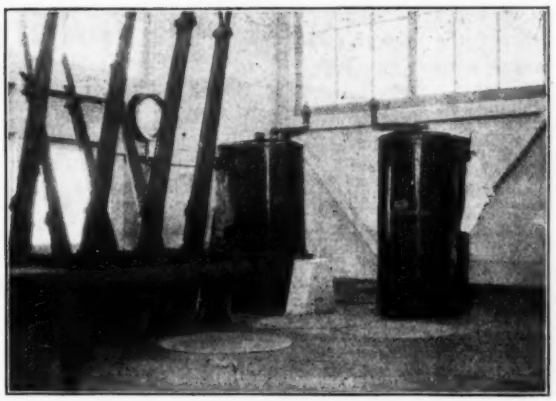


Fig. 2.—220-Volt Controllers in Lever Room.

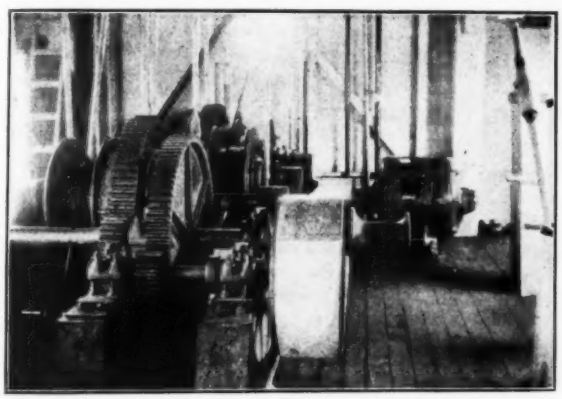


Fig. 3.—40-Horsepower Motor Belted to Six Winches.

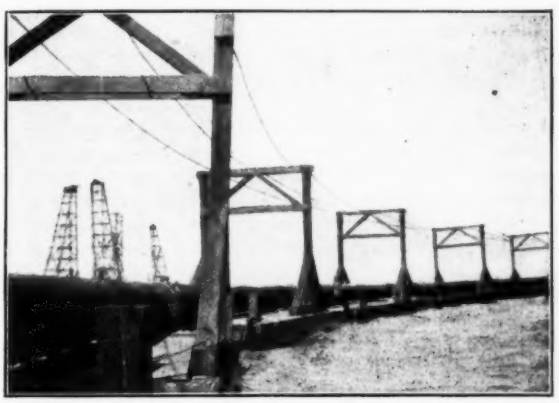


Fig. 4.—Transmission Line Carried on Pontoons.

larger machine to be operated entirely by electricity. The local central station, a Byllesby organization, appreciated the value of a 24-hour load of 800 horsepower and offered to supply current at a very favorable rate. This machine was completed and given its first test on August 21. Everyone interested is pleased with the results.

The power requirements of a dredger are peculiar. The main pump or "sucker" needs a constant-speed motor, while the winches and cutter require variable-speed units. The winches and cutter should be controlled from the lever room, a sort of deck house built above the main structure.

The equipment of the San Diego dredger, named the *Silver Gate*, is as follows:

One 480-kilovolt-ampere, 2,200-volt, synchronous motor direct-connected to 18-inch centrifugal pump.

One 150-horsepower, 2,200-volt, variable-speed induction motor connected through friction clutch to five-foot cutter.

One 40-horsepower, 2,200-volt, variable-speed induction motor connected through changeable gears to six winches.

One 7.5-horsepower, 220-volt, induction motor direct-connected to three-inch priming pump.

All the above are three-phase machines. The lighting equipment includes a powerful searchlight for night work.

The synchronous motor mentioned is a sixteen-pole, ribbon-wound, revolving-field unit with a 15-kilowatt exciter mounted on the main shaft. It operates at 450 revolutions per minute. The switchboard equipment includes a rheostat by which the current entering the fields is controlled. This unit starts as an induction motor; when it has come up to speed the field current is turned on and the load brought on by priming the big pump. The starting switch operates through a compensator which reduces the voltage to 76 per cent of normal. The exciter furnishes direct current at 125 volts.

Next in importance is the 150-horsepower unit which operates the mud cutter. This machine is mounted at the head of the "ladder" which supports the cutter shaft and the suction pipe. As the ladder is constantly changing its position through a range of 45 degrees from the horizontal, special bearings were necessary for this motor so that the oil rings would float at all angles. The motor is connected to the cutter shaft through a friction clutch which will allow the cutter to slip in case any obstructions are encountered.

This motor and the 40-horsepower unit used to operate the winches are both controlled from the lever room. Both are reversible and have a wide range of speed up to a maximum of 585 revolutions per minute. The controllers vary the speed by means of grids introduced into the circuit of the secondary windings and reverse by transposing two leads in the primaries. All operations of the dredger are managed from this room and it is here that the advantage of using electric power is most apparent. Some small operations require power for less than a minute and can be performed in less time than it would take to signal the engineer on dredgers of the other types. Three men: leverman, electrician and deckhand, constitute a full crew. Three shifts are used for continuous operation.

The small 220-volt unit on the priming pump is controlled by a star-delta controller.

Following is the switchboard equipment:

Main panel: 300-ampere main-line oil switch, ammeter for each phase of service, including wattmeter, power-factor meter and voltmeter.

Motor panels: ammeter for each phase of service, indicating wattmeter, power-factor meter and voltmeter.

Motor panels: ammeter for each motor, direct-current ammeter and direct-current volt-meter for exciter, field rheostat for synchronous motor, and oil switches for each motor. All the switches have no-voltage and over-load releases.

The Crocker-Wheeler Company furnished the motors for the *Silver Gate*, and they were installed under the supervision of H. J. Lawrie of the Los Angeles branch. Controlling apparatus was furnished by the Cutler-Hammer Manufacturing Company, instruments by General Electric Company, and oil switches by Westinghouse Electric and Manufacturing Company. The dredger was built by the Union Iron Works, of San Francisco and cost $45,000.

The *Silver Gate* will handle 350 cubic yards of mud per hour through 2,500 feet of 18-inch pipe. While no reliable figures are obtainable at this time, the superiority of electric power is very apparent and the engineers hope to reduce the cost of operation to four cents per cubic yard. Current costs 1.5 cents per kilowatt-hour.

It is a welcome addition to the business of the central station. Besides being a big help to the valley load, the use of a synchronous motor of this size is bound to benefit the power-factor of the distributing system.

Service is carried out to the dredger on trees built on the pontoons. From the last pontoon 200 feet of 4/0 triple-conductor submarine cable runs to the switchboard, thus keeping the deck clear of all wires and allowing considerable latitude of operation without changing the lines.

The use of electric power for dredging is not new, although it is still a novelty in the West. This is the largest machine in use on the Pacific Coast.

Suggestions for Showroom Wiring.

If the advocates of gas lighting were able to offer similar facilities for the control of their unsavoury product to those available with electricity, they would adopt very energetic steps to ensure that the public was familiar with such conveniences. No gas consumer could plead ignorance of the possibility of two-way, master, restricted, and similar controls if such were adaptable to gas lighting. The gas companies and their commercial association would see to it that the advantages of these systems of control were brought to the knowledge of every user of gas. In every gas showroom, in London and local newspapers, at exhibitions and demonstrations, in season and out of season, such controls would be boomed for all they are worth. Yet how little is heard of them in the electrical industry! They constitute an unique feature of electric light, and one that adds materially to its comfort and convenience, but for some obscure reason consumers as a whole are left in ignorance of their existence. Who is responsible for this neglect of a valuable argument in favor of electrification? Is it the contractor, the station engineer, the consultant, or the architect, or must we blame the builder? We are afraid that the blame may fairly be distributed among them all. Few contractors know themselves what possibilities exist for multiple and special controls of electric light, the station engineers seldom trouble themselves over such "details," the consultant and architect as a general rule are as ignorant about them as the average contractor, while the builder objects to spending the few extra pounds involved in completing an installation on modern lines. In selling so adaptable and convenient a product as electricity, the salesmen should be fully conversant with its applications and with those features that make it unique as an illuminant. Every outside representative should be fully posted up in its advantages and the methods of control available, yet few such men are aware that anything beyond two-way control is now available.

Little is done to educate those who come into direct contact with the consumer, in anything but the merest outline of wiring schemes, and the classes for wiremen at technical colleges concern themselves but little with modern methods of control. It

is high time that those responsible for the commercial development of electric lighting should bestir themselves and learn something about the applications of their own product if they do not know already, and see that their subordinates are equally familiar with them. Contractors could spread the gospel of up-to-date control by wiring their showrooms to demonstrate some of the systems that offer the most advantage to consumers. Obviously the public cannot demand refinements in switch control unless it knows of their existence, and if they are shown in use at the local showrooms, the public can see and test their value. Any intelligent consumer, having once realized what modern methods of control can do for him, will be only too anxious to have one or other included in his installation, and he will not be slow to point out their advantages to friends and neighbors.

The circuits of greatest utility in ordinary domestic lighting include:—(1) Two-way and intermediate control, (2) master control, (3) restricted lighting, and (4) dimmed-light switching. The first permits of the control of a lamp or group of lamps independently from any number of switch points; the second prevents lights being turned on, or alternatively prevents them from being turned off, at the other switches, or, again, it may alter the number of lights controlled by the other switches; the third control system restricts the number of lamps in use at any one time, while the fourth makes it possible to get subdued lights by placing two or more lamps in series.

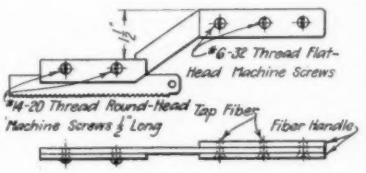
Aside from those four classes, there are many other controls and modifications of those referred to, such as pilot and burglar-alarm circuits, variable control from two or more points, and so forth, some of which it would be advantageous to demonstrate. Staircase lighting, for example, is seldom carried out scientifically, and if the showroom be on two floors, it would be instructive to show how this can be done with two-way and intermediate switches. The lighting of cupboards and storerooms, in conjunction with momentary contact, or automatic spring-on and off switches, is seldom taken advantage of, but adds to the convenience of an installation, and tends to minimize waste of current.

A contractor, asked to provide a circuit a little out of the common, should not be obliged to refer the point to the switch makers; he ought to be familiar at least with the commoner systems, and to have the needful wiring schemes ready worked out, preferably in actual practice in his showroom or, in default, on paper.—*The Electrical Times* (London).

Tool for Slotting Commutators.

A tool that I have found exceedingly convenient for holding a hacksaw blade for cutting down mica in the commutators of direct-current motors and generators can be made in the manner indicated in the accompanying figure. The necessary material consists of one-quarter by five-eighths-inch strap iron and a small amount of fiber—and, of course, the screws for holding the parts together. The iron blade-holder is given a 1.5-inch offset to raise the handle of it away from the commutator. The handle is made of fiber.

In this tool for slotting commutators either heavy or thin hacksaw



Details of Tool.

blades may be employed, depending upon the thickness of the mica to be cut. When the mica between the commutator segments is very thin it may be advisable to take a little of the so-called "set" out of the blade of the hacksaw to be used in the slotting. This can be done by holding it flat on an emery wheel for a moment; it should be held on the wheel until it is thin enough to move freely in the slot without cutting the copper.

In slotting a commutator with this sort of tool it is best to start the slots with a four or five-inch knife file.

H. W. Parsons.

High-Frequency Ammeters.

For the measurement of current at radiotelegraphic frequencies, about 50,000 to 2,000,000 cycles per second, it is general practice to utilize the thermal effect of the current. The electrodynamic effect of the current has not been very successfully utilized; because, when the wire is coiled up to form an electrodynamometer, conditions are favorable (impedance large and capacity large) for part of the current to flow through the dielectric instead of the wire, in amount varying with the frequency. The superiority of the hot-wire ammeter and the modifications thereof, in high-frequency work, is due to the simplicity of form which the portion of the circuit within the instrument may have, permitting a minimum of self-inductance and capacity. A single straight wire of very small diameter is the only form of ammeter circuit which can be taken as *a priori* reliable at all frequencies. When the instrument is required to carry relatively large currents, such a wire is not sufficient, and more than one elementary path must be provided for the current. The distribution of current among these paths is determined solely by the resistances, at low frequencies, while at high frequencies the inductances predominate. Consequently, the current distribution and the readings of the instrument are likely to change as the frequency is varied.

There are three general types of ammeters in use for large currents of high frequency: that employing wires in parallel, the so-called unshunted ammeter in which a single wire has different portions of its length in parallel, and the ammeter employing thin metal strips. Both experimental and commercial instruments of all these types were investigated, experimentally and theoretically, by J. H. Dellinger, and will be described in a paper to appear in the *Bulletin of the Bureau of Standards*. All types were found to be subject to errors at radiotelegraphic frequencies. This fact is of great moment, for the ammeter is the cardinal instrument in high-frequency work. It is of value in measurements of resistance and power, as well as of current. In some of the ammeters investigated the readings were found to increase with increase of frequency, and in others to decrease. These changes are entirely independent of the thermometric method used to measure heat production. The thermometric device may depend on expansion, calorimetry, electric resistance, or thermoelectric effect.

The observations were made by passing high-frequency and low-frequency current successively through the instruments. An instrument under test was always in series with an instrument which could be taken as standard, and the two were observed simultaneously. Thus the ratio of indicated current at high and low frequency, for equal total current in the circuit, was obtained. The high-frequency current was generated by the oscillatory discharge of a condenser across a spark gap. The instruments were in a secondary circuit, loosely coupled to the primary, and consisting of an inductance coil, the instruments, and Leyden jars, in series. The chief source of accidental error in the observations was the slight unsteadiness of the current together with the differing lag of the indicating devices of the instruments.

From the dimensions and arrangement of the wires it was found possible to predict quantitatively the changes of reading of the wire instruments with frequency, while theo-

retical considerations also made it possible to predict qualitatively the performance of the strip instruments. It is an interesting coincidence that the changes of reading occur just in the range of radiotelegraphic frequencies. In some of the instruments, the current distribution was constant from low frequencies up to about 100,000, then underwent changes, and became constant for 1,500,000 and higher frequencies.

In the case of the parallel-wire ammeter, mutual inductances between parts which had hitherto been supposed to be negligible are the determining factor in the change of current distribution. In the so-called unshunted ammeter, the errors are chiefly due to the self-inductances of parts other than the hot wire. In this case, they can be minimized by symmetrical location of the current leads. In the strip ammeter, the terminal blocks have been found to be the source of large errors. These are reduced by proper shaping of the blocks.

One effective means of reducing the errors of these ammeters at high frequencies is by using working parts of high resistance, that is, metal wires or strips which are very thin and of high resistivity. Another expedient is to change the design so that the deflections depend on the entire heat production in the instrument instead of on that in one branch of its circuit. It was found possible to apply this idea to the thermocouple instruments, as well as to those whose indications depend on other thermometric principles. Still another method of improvement is to arrange the working parts (either wires or strips) as equidistant elements of a cylinder, so that each has the same set of mutual inductances. This design approaches as a limit the circular tube, which theoretically has no change of current distribution with frequency. In common with the others, however, it is subject to an error which has hitherto been overlooked. It is difficult to obtain very thin wires or strips of uniform cross-section, and this variation results in the resistances of elements being unequal while the inductances are substantially equal. As a result the current distribution may be uniform at high frequency and not at low frequency.

Eddy currents induced in neighboring masses of metal are found to cause no error. Inductive action of the leads near an instrument in some cases appreciably affects the readings, and must be guarded against. The distributed capacity of the circuits within the instruments is found to cause no error, but the capacity of auxiliary parts produces an appreciable effect at the highest frequency used, 1,500,000 cycles per second. This effect was very striking, two instruments in series carrying different amounts of current. Apparently part of the current was shunted out of one of the instruments by electrostatic induction.

Kansas Contractors Meet.

The Electrical Contractors' Association of the State of Kansas was in session at Hutchinson, Kans., throughout the day Thursday, October 9, this being an adjourned meeting. The Association was organized at Topeka last May, and the one-day session just held at Hutchinson was arranged for then.

From the drift of the proceedings at the Hutchinson meeting it appeared that the matter nearest the heart of the Kansas body was the segregation of business in the electrical field in that state. The contractors feel that there is too much overlapping and friction and wasteful, unnecessary competition. To remedy this condition in the state will be one of

E. L. Staley, President, Kansas Electrical Contractors' Association.

the first tasks undertaken by the Kansas Association. At the meeting Thursday W. R. Meeks was appointed as the agent of the Association to confer with the officials of the National Electrical Contractors' Association looking toward the arrangement of plans for remedying the present practices where these are bad. The Kansas contractors hold, it seems, that the fields of the manufacturer, the jobber, the retailer, the central station, and the contractor should be made more distinctive—that each of these interests should stay out of the business of the others.

The Kansas Association is one of the youngest of the state organizations, as just noted, but it has enthusiasm and is rapidly gaining in strength. The president of the Association is E. L. Staley, of Wichita. Mr. Staley is a member of the firm of Staley & Fees, one of the best known contracting concerns in his city. The vice-president of the Association is I. C. Busong, of Ottawa, while J. A. Mercer, of Topeka, and J. R. Woodhouse, of Atchison, are respectively secretary and treasurer.

The next regular meeting of the Kansas contractors will be held in Topeka in May, 1914.

Electrical Work in a Large Hotel.

It is stated that there are 41 miles of electric circuits in the new Hotel Wisconsin, at Milwaukee, a building in which the electrical work was installed by George F. Rohn, of Milwaukee. There are 43 electric motors, which have an aggregate output of about 400 horsepower, of which 80 horsepower is used in operating the blowers in the ventilating system. This is the largest electrical installation in any hotel in the Northwest, it is said. The elevators are operated by electric motors, as are laundry machines, pumps, blowers, refrigerating machines, mixers, drippers and other kitchen machines, etc.

All the wiring in the building is carried in iron conduits. Every room in the building has a center light fixture and also a dresser light, while all bath rooms are equipped with curling-iron plugs for the convenience of lady guests.

The main switchboard, from which all the lighting and motive power is controlled, weighs, with its necessary equipment, in the neighborhood of 6,000 pounds and has a total length of 15 feet.

In addition to the lighting and power installation, the contractor mentioned also wired the building for the long-distance telephones found in every room and for the telautograph system which enables each guest to obtain prompt attention from any department of the hotel service. There are 600 telephones, which are all connected to a private branch exchange.

Holabird & Roche, of Chicago, were the architects of the hotel.

Metallic Beryllium.

Two German investigators recently made some experiments on the reduction of metallic beryllium. The metal was obtained by the electrolysis of a fused mixture of the pure fluorides of beryllium and sodium. The product was purified from adherent oxides by centrifuging the fine powder in a mixture of ethylene bromide and alcohol. It was then compressed into cylinders and fused. The metal, after melting, had a specific gravity of 1·842, melted at 1,280 degrees centigrade, and did not volatilise at 1,900 degrees. It does not tarnish readily, and the authors say that its apparent inertness is, like that of aluminium, due to a film of oxide. It will be noticed that beryllium is much lighter than aluminum.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Connecting Lamps on a Three-Phase Circuit.

I have found the arrangement illustrated in Fig. 1 to be very serviceable when I have to connect incandescent lamps directly on a three-phase, three-wire circuit. I connect the lamps in what is commonly known as the star grouping. It will be noted that any one of the three lamps shown in the figure may burn out without affecting the burning of the other two.

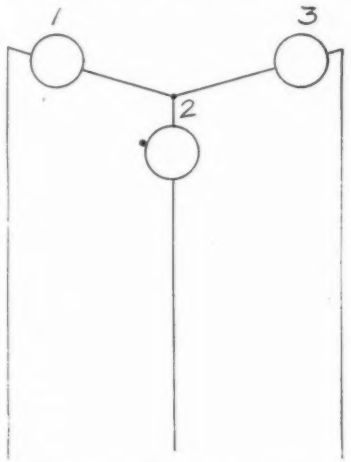


Fig. 1.—Arrangement of Lamps.

These lamps may be connected in a cluster, or each lamp may be in a different room. If not in cluster form, switches may be inserted on two of the legs of the circuit so that two lamps at a time may be burned and the other turned off whenever this is desired.

Harold M. Speck.

Hanging a Large Fixture.

On a job that I undertook not long ago some large fixtures had to be hung on the ceiling, and I found it quite difficult to make the connections properly and at the same time hold the fixture in place. Finally I hit upon the following scheme, and it worked well.

Instead of hanging the fixture with the pipe that was to be left in service I used a piece of pipe six or eight inches longer than this, this being placed between the fixture stem proper and the fixture stud. In this way I was left ample room to make all of the circuit connections. When these had been made properly I took the longer piece of pipe out and replaced it with the fitting that was to be employed in permanent service.

Edward McMannus.

Installing a Pendent Switch.

In the installation of fixtures the electrician sometimes finds it necessary to install a pendent switch by looping in at the side of the fixture canopy, and it may be that he has to cut the hole in the canopy for the fixture cord. When such is the case I find that the hole can be very readily drilled with a common wood bit of the required size. Just punch a small hole in the canopy with a sharp punch or nail. Into this insert the worm of the bit and as soon as the cutting edges strike the metal of the canopy reverse the direction of rotation. The cutter will cut out a round piece of the metal and leave a clean hole without any burr at all to be reamed off. The bushing may then be installed and the locknut screwed up. A five-eighths-inch bit should be used for three-eighths-inch bushing.

C. C. Sisson.

An Electrician's Knife.

I have noticed many electricians using a knife, and I have never seen one that did not make use of the regular cutting edge both for stripping the insulation off of wires and for cleaning the wire after the outer part of the insulation had been removed.

If one will take a file and draw it over the back of the knife blade a few times it will be found that two working edges can be obtained on the blade. The fine edge should be used only for taking off the outer part of the insulation.

It is also a good plan to give the cutting edge of the blade a shape something like that of a cold chisel.

B. C. Strong.

The Switch Box Was Not Flush.

Recently I wired a house where flush-switch boxes had to be installed throughout. Everything worked out nicely when I went to put in the switches, except when I got to the bathroom, which had a tile wall installed in it. The tile setter had set the wall seven-eighths of an inch out where the switch box was located, and this left the box back in the wall two inches. I was not able to get screws long enough to secure the switch in the box, so I took two nails and sawed them off two inches long and cut a slot in the head of each one of them. Then, taking a six-thirty-second-inch die, I threaded the end of each nail. With these I was able to reach the box and to fasten the switch in satisfactorily.

Lewis T. Haldeman.

Abandoning Wires in Walls.

A few days ago I had occasion to fish some wires in for the purpose of putting some lights on switches, the lights having originally been wired "straight in." The new wires left a wire on one side of each of the outlets that would not be used, and I was rather in a quandary how to protect these wires so I could push them back above the ceiling. I finally hit upon the following plan which looks good to me. I cut off a piece of loom that I was sure was long enough, and doubled a piece of tape and pulled it through with a wire. I made a loop in the end of the wire I intended to abandon, first putting the loop of the tape in it. With the tape I then pulled the wire into the loom, pushing the loom up into the ceiling as far as it would go, the tube on the wire being pushed ahead of it. I then tied a large knot

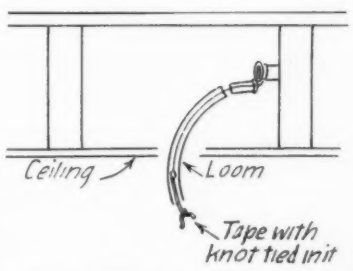


Fig. 2.—Method of Covering Wire.

in the tape at the end of the loom, and the wire was safely covered with loom and ready to be pushed back into the ceiling and left. The wiring job was an old one, put in when tubes coming through the ceiling were considered good practice.

C. W. Goddard.

Paraffin as a Lubricant.

In a recent wiring kink M. J. Moriarty recommended the use of paraffin for lubricating a fish tape. I should like to know whether he ever used it on wires? In a large job of wiring that I had on hand not long ago there were conduits that were long and had frequent turns in them which had to be rather heavily loaded with wires, and we found it difficult at first to pull the wires into some of these. Finally we hit upon a scheme of using paraffin to lubricate the wires, and we found that the use of this made the pulling-in comparatively easy.

O. S. Livergood.

Public Service Commissions

MASSACHUSETTS.

The Massachusetts Gas & Electric Light Commissioners have approved the issue, by the Haverhill Electric Company, of 2,122 shares of new capital stock, par value $100, at the price of $130 per share. The proceeds of 1,038 shares are to be applied to the payment of notes outstanding March 31, 1913, and of 1,084 shares to the payment of cost of additions to plant made after that date. The company asked approval of an issue of 2,784 shares which included cost of new construction, extensions and additions to plant. Since the last stock issue additions have been made costing $135,000, which is represented by the notes referred to. Other construction work proposed as a basis for the issue of stock was estimated to cost over $228,000. Abcut $80,000 of this was for minor additions possible during the three years succeeding March 31, 1913, which will be dependent upon the number of new customers that will be secured during that time. Of this sum about $13,000 had been expended up to June 30. The Commission withholds its approval of stock for the unexpended portion of the $80,000, on the same grounds as those set forth in the decision referred to in our issue of October 11, in the case of the Suburban Gas & Electric Company, of Boston.

Customers of the Marlboro Electric Company have petitioned the Commissioners, asking for lower rates for electricity in that city.

The Public Service Commission of Massachusetts has approved the use of the Kilbourn track-sanding device, the Brill "Dumpit" sand box, Sprague's rotary sand box, the Sault vacuum sander and the Murphy track sander, on petition of the Berkshire Street Railway Company and the Boston & Worcester Street Railway Company. The use of the Kilbourn track-sanding device and the Loring sand box by the Taunton & Pawtucket Street Railway is also approved.

The Commission has approved the location of tracks of the New Bedford & Onset Street Railway Company in the state highway in Mattapoisett, and of the Boston Elevated Railway Company in L and P Streets, South Boston.

NEW YORK.

The Public Service Commission for the First District is advertising for bids for the construction of section No. 3 of the Seventh Avenue subway in Manhattan. Bids will be opened on November 10 at 12:15 o'clock. The Seventh Avenue subway is to be operated by the Interborough Rapid Transit Company, and section 3 covers that portion of the route in Varick Street and the Seventh Avenue extension between Beach Street and Commerce Street. The cost of this work will be defrayed by money contributed by the Interborough Rapid Transit Company.

During the last week the Public Service Commission for the First District has executed the contract awarded a short time ago to the Snare & Triest Company for the construction of section No. 1 of the elevated railroad in Queens. This contract embraces the junction station at the Queensboro Bridge Plaza, where the Astoria and Corona lines separate. The contract price for this section is $880,000.

According to the reports of the engineers of the Public Service Commission for the First District, there is now under contract $83,000,000 worth of work on the new subway lines of the Dual System of rapid transit and an average daily force of 7,000 men is employed thereon. Of the $83,000,000 worth of work, about $38,000,000 is on lines to be operated by the Interborough Rapid Transit Company and $45,000,000 on the lines to be operated by the New York Municipal Railway Corporation. Of the latter, however, the Fourth Avenue subway in Brooklyn and the Center Street Loop subway in Manhattan, costing together about $28,000,000, are practically completed. It is estimated that the construction work on the city-owned lines will cost about $200,000,000. There is, therefore, about two-fifths of the value of this work already under contract. Of the remainder, to cost $117,000,000, it is expected that more than one-half will be under contract before the end of the year, so that by that time, nine months after the signing of the Dual System operating contracts, actual construction work will be in progress on three-quarters of the city-owned lines.

NEW JERSEY.

The Board of Public Utility Commissioners has dismissed the complaint of James Chittick against the New York Telephone Company, claiming that his telephone service had been temporarily discontinued for failure to promptly pay bills rendered, and that upon willingness to settle the account the company demurred to a pro rata reduction for the period of curtailed service. In dismissing the case, the Board refuses to disturb the contract requirements of the company providing that service may be stopped between the tenth and fifteenth of that month in which payment is due, if bill is not paid when due, and holds that with such agreement the company has the right to curtail service to a patron under conditions stated.

Electrically Lighted Show Windows and Signs in India.

The use of electric signs at night, though small as yet in India, is increasing. Some leading shops in the larger cities are beginning to see the advantage of brilliantly illuminating their windows at night. At present very little attention is given to attractive show windows, chiefly because the excessive sunlight would cause fading of many articles so displayed. Moreover, people do not like to stand in the glaring sunlight gazing at the show windows. In Madras most of the leading shops have no show windows at all, and except for the signs it would hardly be noticeable that these shops are not private residences. However, by building some shading structure over the windows the disadvantages of the strong sun can be minimized. Moreover, in the evening well lighted windows may always prove attractive. The largest department store in Bombay has recently experimented with electrical illumination for several good show windows and has found that it has attracted large numbers of people, who walk past the shop at night to see the display. This firm has decided that it will be good advertising policy to have just as many show windows as possible and all brilliantly lighted at night.

The rapidly increasing popularity of electric fans in India is evidenced by the fact that over almost every desk in offices of any consequence is to be found a powerful electric fan. The old-fashioned punkah is being less and less used.

CONVENTION OF KANSAS ELECTRICAL ASSOCIATION.

Sixteenth Annual Meeting of Kansas Gas, Water, Electric Light and Street Railway Association Held at Hutchinson, October 9, 10 and 11.

As is apparent from the above heading, the Kansas Association nominally includes a somewhat large variety of interests. But at the convention held in Hutchinson last week attention was confined mainly to electrical matters; in fact, most of the papers read were of a kind to interest especially the central station man or the operator of an electric railway property.

The convention was a working convention; about twenty papers were read and discussed and much in the way of association business taken care of during the six sessions. There was very little in the way of entertainment, there being practically no time for this sort of thing. Without an exception, the papers showed familiarity with the subject, and careful preparation. And the subjects were well chosen.

The initial meeting was called to order Thursday afternoon at two o'clock, with L. O. Ripley, of Wichita, the president of the Association, in the chair. Mr. Ripley introduced the mayor of Hutchinson, who welcomed the Association to the city. During his remarks the mayor took occasion to comment upon the attitude of the public toward the public utility company. He said that in Hutchinson the people felt very kindly toward the public utility interests. The mayor's talk was responded to by B. F. Eyer, of Manhattan, after which came the president's address. President Ripley spoke at some length upon the work of the Association, and called attention to some changes proposed by the Executive Committee which would come up for final consideration during the convention. In the course of his talk he read a letter from J. Robert Crouse inviting the Association to send a delegate each year to the annual meeting of the electrical interests at Association Island. He also announced that the American Gas Institute had invited the Association to participate in the Gas Congress to be held in San Francisco in 1915.

Special Street Illumination With Concrete Poles.

The first paper read before the convention was by F. A. Pielsticker, of Eldorado, Kans., who described some construction features of a new ornamental street lighting system in his town. His paper is summarized in the following paragraph.

This paper describes a lighting system recently installed in the downtown district of Eldorado, Kans. Tungsten lamps on concrete posts are employed. There are three lamps on each post, approximately 12 feet above the sidewalk. The post is of octagon shape and is built of sand and cement mortar. A 1.25-inch pipe runs through the center of the post, and a three-quarter-inch pipe through the arm, which pipes serve as the only reinforcement and as conduits for the wires, and also afford a method of connecting the arm to the post, the former being built separate from the latter. The post is built with the main column on a 9.5-inch circle at the bottom and tapers to a 7.5-inch circle at the top, with an octagonal base 14 inches in diameter and 8 inches high. It is bolted to a foundation that is square in cross-section and 12 inches in height with four half-inch anchor bolts, which were set solid in the foundation when this was built. The arm is 38 inches long, 5 inches high and 4 inches thick, and the pipe in the center of it is fastened to the one in the arm with a 1.25 to 0.75-inch reducer. The forms used in building the posts were made of ordinary one-inch cypress, the completed form being split into halves which were held together with 0.25 by 0.75-inch bar iron bent to fit the outside of the form and fastened together with bolts. When, in building a post, the concrete had set sufficiently the form was taken off and bolted in place for another post. The concrete mixture was poured into the form at the top. To provide means for bringing the wires in from the underground distributing system the bases of the poles were left hollow in the center up to a point a little above the ground line. After the posts and arms were thoroughly dry, the posts were set in place, the arms screwed on and the globe holders attached to the central reinforcing pipes with standard fittings, both posts and arms having been wired before they were taken away from the plant where they were cast. The cost per post complete was $8.19, including wire, lamps and globes. There are 51 of these three-lamp posts in service now, eight to the block, four on either side of the street, and 60-watt lamps are used throughout. The top lamp is in a 12-inch globe, and the two at the ends of the arm in 10-inch globes. Multiple circuits are employed throughout the distribution, these consisting of lead-covered cables drawn into fiber conduits. The total cost of the system, including the underground wiring and all other items, was almost exactly $2,000, which is equivalent to about 87 cents per foot of street lighted, or 43 cents per foot of frontage illuminated. Since February 1, when he lamps were first turned on, the maintenance cost has been $23.52.

Mr. Pielsticker was followed by C. L. Bulluck, of Wichita, who presented a paper on the development and transmission of natural gas.

The Half-Watt Lamp.

At this point in the proceedings the chairman of the convention called upon George B. Walker, of St. Louis, Mo., to speak upon recent developments in incandescent lamps. Mr. Walker referred to the nitrogen-filled lamp, or the half-watt lamp, as it is sometimes called, which is now being developed, and said that a 5,000-candlepower, 2,500-watt lamp of this type had recently been used as a part of the illumination at the Veiled Prophet's Ball in St. Louis. Mr. Walker stated that F. T. Benson, of Chicago, was in a position to speak in greater detail concerning the new lamp, and that after a few further remarks he would therefore give Mr. Benson the floor. The speaker then took up the subject of the losses due to operating incandescent lamps at voltages lower than that for which they are rated, prefacing this part of his paper with a note concerning the history of the electric incandescent lamp. Mr. Walker showed that when lamps are burned at voltages that are low the consumer gets less light per watt than is obtained with the rated top voltage and that the central station loses revenue. He contended for operation at top voltage.

Following Mr. Walker, Mr. Benson said that the new half-watt lamp was a unit which promises to bring about some very important developments in the field of artificial lighting. It looked as if the lamp was going to be a low-voltage proposition; 29 or 30 volts would probably be the working pressure. The intrinsic brilliancy of the lamp is high, being five to ten times that of the standard tungsten lamp. The color is good, and it is possible to make the lamp so that it will maintain its efficiency and candlepower constant throughout its life. For series operation in street lighting this unto will doubtless be a most formidable rival of the arc lamp. It also seems especially suited to the lighting of large interiors where it is desired to secure daylight colors. The lamp can be screened so as to produce daylight effects without reducing the efficiency below two watts per candle.

The Jovian Order.

Mr. Benson's address concluded the Thursday afternoon session. At the evening session, which opened at eight o'clock, the first part of the program was an address by P. Lloyd Lewis, of Kansas City, Mo., on Jovianism. Mr. Lewis said that the order was founded in 1899, and that the charter members numbered 40. There are now 13,000 members, and these include most of the more prominent men in the electrical field in the United States and Canada. The humblest electrical worker may become a member of the Order. Mr. Lewis spoke of the co-operation of the Jovians in the matter of raising funds for the Society for Electrical Development, and declared that from the day the Order undertook to assist in raising this money he had not doubted at all that the necessary amount would be secured. In the course of his remarks, Mr. Lewis turned aside for a moment to make some very interesting suggestions concerning the selling of electric service. He said that

the dealer and the central-station man ought to insist upon the salesman of the manufacturer and of the supply house helping in obtaining new business. If, for example, the central station has a power prospect who has not become entirely convinced of the advantages of motor drive, the representative of the manufacturer of motors might be called upon to spend any spare time that he had in the town helping talk up the proposition.

Treatment of Poles.

F. B. Uhrig, of Kansas City, Mo., was the author of the second paper of the Thursday night session. In substance, his paper was as is given below.

This paper began with an historical account of developments in the use of poles for carrying electric wires, and then went into a description of the methods employed in cutting and marketing poles. Numerous lantern slides brought out in a striking manner some of the more interesting facts about these processes. Passing on to methods of treating poles to increase their life, the speaker said that three methods were in modern use. Poles are treated by (1) the closed-tank pressure method; (2) the open tank method; and (3) the application of a preservative compound in liquid form by means of a brush. Dead oil of coal tar, or carbolineum, as it is called, is the preservative substance. Poles treated 50 years ago are still in service. In the closed-tank method of treatment, the antiseptic preservative is forced into the outer part of the pole to a depth sufficient to prevent exposure of the untreated inner portions by abrasion, checking, etc. The open-tank treatment consists in placing the butt end of the pole in a tank into which an antiseptic preservative, preferably carbolineum, has been poured to a depth sufficient to cover the pole for a distance of about eight feet, or from the butt to a point two feet or so above the ground line. The oil is then heated to a temperature somewhat greater than boiling water, which temperature it seems to be the best practice to maintain until air bubbles cease to appear at the surface of the liquid. The oil should then be allowed to cool; or else the poles transferred to another tank containing cold oil. Into the partial vacuum thus produced, the pressure of the air forces the preservative. A treatment by this method consumes about 24 hours, during which the pole is in hot oil for eight or nine hours. The third method of treatment is commonly known as the brush treatment, and consists of applying the carbolineum to the base of the pole with a brush. The oil should be applied from the butt to a point a foot above the ground line, and the bottom of the butt should be covered. Only seasoned poles should be treated, and the wood should be dry when the preservative is put on. It is preferable that the preservative be applied hot—at a temperature of 150 to 175 degrees Fahrenheit. An average 30-foot pole will absorb about half a gallon of the oil if it is properly applied. The method of treatment is simple and effective if it is properly applied.

Friday Morning Session.

The Friday morning meeting of the convention was opened with a short executive session, at which B. F. Eyer reported a number of recommendations made by the Executive Committee of the Association. The recommendations which were adopted by vote of the convention included a provision for dividing the membership of the Association into three classes, A, B and C. Class A membership will be limited to public service companies and the representatives of municipally operated utilities. Class B membership will be made up of employees of concerns entitled to Class A membership, and of manufacturers, jobbers, contractors and others dealing in commodities used by Class A members. Class C members are to be honorary members. The convention also decided to adopt the recommendation that a question box be conducted at the next annual convention of the Association. Communications for the Question Box are to be sent to W. E. Sweezy, of Junction City, Kans. The proposal to change the name of the Association was deferred for one year for action, pending final action on the matter of making the Association a purely electrical organization and a section of the National Electric Light Association.

Irrigating Kansas Lands.

The first paper of the morning was by H. B. Walker, of Manhattan, Kans., on the above named subject. The speaker, who has been carrying on extensive investigations for the State of Kansas, felt that irrigation from wells was going to prove of great value to agriculture in some sections of the state. Where there is irrigation now, a difficulty is that the pumping is inefficient; the farmers try to operate the pumps with small engines and they know next to nothing of how to handle the machinery. He expressed the belief that motor-driven pumps connected to the lines of the central station in the neighboring town would be the solution of the problem.

Discussing Mr. Walker's paper, L. O. Ripley, of Wichita, said that the Kansas Gas and Electric Company, of Wichita, was looking for business in the line pumping for irrigation. Wells are now being sunk on a farm near the city, and motor-driven pumps will be put in. This installation is somewhat in the nature of an experiment, but it is believed that it will prove to be successful.

In a most interesting paper on "Fire Insurance," E. E. Wakefield, of Chicago, urged the central-station men present to insist upon high-class electric wiring in buildings to which their lines are to be connected, and to give attention to such matters as the proper storage of oil, the careful disposal of oily waste, etc. Mr. Wakefield urged the necessity of provisions which would prevent unlicensed wiremen from installing inside circuits.

This paper was discussed briefly by P. Lloyd Lewis, F. B. Uhrig, C. M. Lewis, of Kansas City, Mo., and other members.

Friday afternoon the session began with an illustrated paper on the manufacture of concrete poles, C. L. Brown, of Abilene, Kans., being its author. An abstract of Mr. Brown's paper follows.

Manufacture and Installation of Concrete Poles.

The Riverside Light and Power Company, of Abilene, Kans., has been developing and installing a hollow reinforced-concrete pole for the overhead distribution of electric power. These poles have been made in four different sizes: a pole with 6-inch top and 10-inch butt, which takes the place of 6 and 7-inch top, 20-foot cedar poles; a pole with 6-inch top and 11-inch butt, to replace 7 and 8-inch top, 25-foot cedar poles; a pole with 6-inch top and 12-inch butt, which is substituted for 7 and 8-inch, 30-foot wooden poles; and a pole having 6-inch top and 13-inch butt diameter, which is used to replace 35-foot cedar poles up to 8 inches in top diameter. The poles are octagonal in cross-section, and taper gradually from 6 inches in top diameter to the sizes of butt just mentioned. They are cast in forms laid horizontal, and are reinforced with four, six and eight carbon-steel rods, the rods being square in cross-section, and being twisted. The rods run through the pole from butt to top. A three-piece mold or form is used in casting the pole. The bottom is a plain pallet of plank as long as the pole. The other two pieces of the form are made of two-inch planks, the length of the pole, increasing in width from 6 inches at the top to from 10 to 13 inches at the base, depending on the length. These two sides are set on their edges on the base or pallet, and held in place with cleats nailed on the outside of the forms. U-shaped irons keep the forms from spreading when the concrete is being poured. The form is completed by tacking tapered three-cornered strips in the corners of it. The concrete mixture consists of a mortar of one part Portland cement to three parts of sand. When mortar has been poured into the form, at the open top side of it, to a depth of about three inches, a core consisting of a hollow cone of galvanized iron is placed in the form, the cone being six inches in diameter at the base and tapering to two and a half inches at the top. The core is wrapped with cheap building paper cut into strips, and wound on spirally, which permits the cone to be drawn out when the concrete has set. After the cone is placed two of the reinforcing rods are laid in at equal distances from the sides of the form and the core, and then the mold is filled about half full of mortar and thoroughly tamped. Then two more reinforcing rods are put in, and the form filled until the mortar covers the core; after which the remaining rods are put in place, the form filled with the cement mixture, this thoroughly tamped and the top side of the pole smoothed off with a

trowel. When the concrete has taken the initial set, the core is pulled out, and in from 24 to 48 hours the form is removed and the pole rolled off to the ground where it is left from 25 to 30 days to cure. During the curing process the pole should be thoroughly wet every day. Provision for climbing is made by placing nuts in the cement, and screwing galvanized-iron bolts into these through holes in the sides of the form. The bolts are backed out before the concrete has thoroughly set, and can be screwed into place again to form steps, after the pole has been erected. The gains for cross-arms are made by putting blocks in the form before the pole is poured. Wooden or iron plugs placed in the cement at the proper places while it is soft, provide means of attachment for heel bolts, these plugs being removed before the concrete has finally set. Holes for bolting on cross-arms can be provided in the same way, but it is considered preferable to fasten the cross-arms on with U-bolts passing around the pole and through the arm. Cost of pole complete has been found to be only slightly more than the cost of cedar poles, but the cost of setting is considerably greater in the case of the concrete pole. The company has been using these poles about a year and has had no trouble from their breaking. The appearance is good, and the company and the town are pleased with them.

Small Central Heating Plants.

Mr. Brown was followed by H. C. Kimbrough, of Kansas City, Mo., who read a paper on the above subject. This paper dealt with the heating of buildings with steam generated in the boilers of the local central station. Figures made up from tests on actual installations were given to show the profitableness of this system of heating. In some of the installations live steam was used; in others the heating was done mainly with exhaust steam. Where steam was furnished for heating alone, it was transmitted at low pressure, but there were plants which sold steam to nearby industries for driving engines running fans, the steam pressure being 50 pounds. Figures on losses in transmission were given. The author insisted that central station men would find it easier to install motor drive in industrial plants if they would provide for heating the plant as well as for lighting it.

This paper was discussed by A. M. Patten, of Topeka, who agreed that the central station ought not to allow the private electric power plant to be installed where the owner's argument was that he had to have a steam plant for heating and that he might as well, therefore, generate his own electricity too.

Features Common to Public Utilities.

A. M. Patten then read a paper in which he dealt with certain general problems with which public utilities have to contend. Mr. Patten said that it was too frequently the case that a tactless employee was left to deal with the public in matters in which the manager himself ought to represent the company; he thought the manager ought to make himself as accessible to the public as the duties of his place would permit. The speaker emphasized the necessity of getting the employee enthused with the company spirit. He argued, too, that the utility company should always accord the local newspaper courteous treatment; news concerning the company's doings should not be withheld if it was reasonable to give it out, and the public utility should realize that the newspaper has a right to some advertising from it as well as from any other local enterprise. Mr. Patten went on to speak of the necessity of the utility company keeping its property in good looking condition; physical appearances count for much in the matter of creating and maintaining a good impression in the mind of the public. But most important of all was the matter of giving good service; without this company could not succeed

A. L. Newman,
President-elect, Kansas Electrical Association.

This paper was discussed by W. E. Sweezy, H. R. Summerhayes; F. H. Bendit, T. J. Braden, L. O. Ripley and C. L. Brown. Points brought out in the discussion were that the commissioners of public utilities ought to have the right to advise as to whether a competitive company was needed in any case, and that it was the duty of the utility company to protect the stock holders and investors in its bonds as well as to serve the public faithfully and honestly.

"Recent Development in Central Station Electrical Apparatus," was the title of a paper prepared and read by H. R. Summerhayes, of Schenectady, N. Y. While there had been no startling developments, according to the speaker, the paper outlined marked improvements in a very large proportion of the apparatus used in the modern central station. Steam turbines were being built in larger sizes than before, better methods of ventilating electrical apparatus were being employed, etc., etc.

Friday Evening Session.

The fifth session of the convention began with the report of the Nominating Committee, which recommended the following men for election to the offices named, to serve the Association during the next year.

President, A. L. Newman, Arkansas City, Kans.; vice-president, H. W. Magruder, of Liberal, L. K. Greene, of Concordia, and H. S. Sladen, of Wichita; secretary and treasurer, Ivor Thomas, Wichita; executive committee, L. O. Ripley, A. M. Patten, W. E. McFadden, W. A. Scothorn, and J. F. Vail.

The recommendations of the Nominating Committee were adopted and all the officers named above elected by unanimous vote.

The convention then took up the matter of place for the next meeting, and decided to hold this in Arkansas City, sometime in October of next year, the exact date to be determined later.

The convention then listened to a paper by C. A. Fees, of Wichita, whose subject was, "Determining Operating Costs of Power Installations." His paper is printed in full on other pages of this issue. Mr. Fees is a power specialist for the Kansas Gas and Electric Company, and his paper contained results of investigations made in the course of his regular duties. The discussion that followed the reading of the paper was participated in by L. O. Ripley, W. E. Sweezy and W. A. Scothorn. Among other things, it was brought out that in grinding wheat with electric power about seven kilowatt-hours of energy per barrel of flour is needed, the quantity varying slightly with the quality of the wheat.

A paper of the evening session which provoked a great deal of discussion was that by Prof. P. F. Walker, dean of the School of Engineering of Kansas University, who explained a system of university extension work for power plant operatives that his University is working out. The School of Engineering of the University of Kansas proposes to teach men employed in running power plants some of the elements of engineering by correspondence, where the operative desires such assistance and is willing to pay a nominal fee for the instruction. The discussion of this paper was mainly in the nature of unqualified endorsement of the project.

Professor Walker was followed by Prof. George C. Shaad, also of the University of Kansas. Professor Shaad's paper was entitled. "Intangible Values and Their Relation to the Valuation of Public Utilities." This paper will be published in full in these columns in a later issue.

The final paper of the Friday evening session was an illustrated lecture on the "Use of the Internal Combustion En-

gine in the Electric Power Station," F. L. Weakley, of Kansas City, Mo., being the author of this. Mr. Weakley discussed operating characteristics and fuel economies at considerable length and in detail. The lantern slides he showed included a number of installations of different types of oil engines in electric lighting stations.

Saturday Morning Session.

The final session of the convention was held on Saturday morning, October 11. First on the program came a paper on the "Financing of Public Utilities," of which H. P. Wright, of Kansas City, Mo., was the author. In the absence of Mr. Wright, President Ripley, of the Association, read his paper. The author went on to show that the financing of a public utility was a matter which required as much skillful planning as did the design and engineering features of the installation. Care should be taken that the franchise was sound and satisfactory before it was accepted. Franchises, said Mr. Wright, are hard to get changed after they have been once accepted. In matters of this sort the assistance of an experienced lawyer should always be made use of. The writer thought that the initial bond issue of a utility should not exceed some 50 per cent of the value of of the property. There should be preferred and common stock, the former being about one-third of the capital value of the property and the latter about one-sixth. The investor will insist upon being kept informed as to the physical condition of the plant, and if the property is not kept up to date the investor is liable to give trouble. The investor will also watch the standing of the utility in the matter of the goodwill of the community and is liable to become suspicious as to the wisdom of his investment whenever there are signs of a lack of the proper amount of goodwill.

The reading of Mr. Wright's paper was followed with a paper by Charles D. Bell, of Wichita, who discussed "Some Features in the Organization and Development of an Interurban Railroad." Mr. Bell, who is a practical electric railway man, took up the various matters that he considered it important for the manager of a railroad property to consider and discussed them in considerable detail.

Other Convention Notes.

Mr. Bell's paper concluded the regular program of the convention. It was followed by a vote of thanks to the mayor and people of Hutchinson for courtesies extended the Association during the sessions of the convention, and there were also similar votes to the Commercial Club of Hutchinson, and to W. A. Scothorn of the Hutchinson Interurban Railway for his assistance in taking care of the visitors and his constant interest in the promotion of convention matters. The vote to Mr. Scothorn was suggested by Chairman Ripley, who had presided over all the sessions, who said he felt that whatever success he had had in discharging the duties that came to him from his position as presiding officer had in a very large measure been due to Mr. Scothorn's assistance.

As already noted, there was a marked lack of anything in the nature of entertainment, the only thing of this sort being a sight-seeing ride over the city and a visit to a local salt works, these two visits being provided by the local electrical interests. It is perhaps fortunate that nothing more in the way of entertainment was undertaken; just where it could have been put in is not apparent, for, with three long working sessions every day, there was little time for festivities. However, the accommodations at the Bisonte Hotel, which was convention headquarters, were excellent, and a general spirit of good will and fine feeling was apparent throughout the entire meeting. Everybody seemed to have an enjoyable time, and it is certain that all were much benefited. The registration was something over 100.

Electromagnetic Waves in the Atmosphere.

The laws governing the propagation of radio-telegraphic signals through the atmosphere at day and night time are still imperfectly understood, and the recent development of aircraft of various descriptions has hardly benefited the scientific investigation of these and of meteorological problems so far. The signals become weaker with greater distance; but one of the points to be investigated is how far the height above the earth, apart from the mere question of distance, enters into such problems; in other words, whether the signals are affected by the lower density, lower temperature, increased ionisation, and other special features of the higher atmosphere. Some preliminary experiments undertaken for this purpose are described by G. Lutze in the *Physikalische Zeitschrift*. The experiments were instituted by K. Schmidt, of Halle, and the balloon rose from Bitterfeld, near that city. The antenna was a wire hanging down from a drum to a maximum length of 100 meters. In order to get a node near the balloon and to balance the load as well, Lutze fixed three wire rings near the equator of the balloon, two meters apart from one another; the wire was covered with soft rubber insulation merely to prevent its damaging the balloon fabric. A wire 15 meters in length led from the rings to the observer's cage, which was well equipped with apparatus. The intensity of the received signals was determined by the parallel ohm method, resistance parallel to the telephone being reduced step by step until the signals nearly ceased to be distinguishable. The detector was a Schlömelch electrolytic cell which had been doing duty at the Norddeich radiotelegraphic station for months, and which proved quite efficient again after the experiments. The received telephone signals may be assumed to be proportional in intensity to the energy of the radiations taken up by the antenna. A series of sparks was given below for four hours, each time for a quarter of an hour, in slow sequence, by a Braun apparatus. During the experiments on the evening and night of September 24-25, 1912, the distance of the balloon increased to 120 kilometers, and the height above the ground to 1,277 meters. The general result was that the intensity of the received signals decreased as the distance increased, not with the square of the distance, however. If p be the power exponent, then the values of p went down from 1.96 (instead of 2) to 0.88. It was further noticed that for equal distances the signals were weaker when the balloon was at a higher level.

To investigate this latter point further another ascent was made on January 5, 1913, this time about noon, and for a long time the balloon drifted at a level of 6,500 meters above the ground; the direction of the drift was northward, so that the distance from Norddeich, where the signals were given, roughly 300 kilometers, practically remained unchanged. At that great height the signals were only half as strong as they should have been at that distance. The temperature was — 36 degrees centigrade, and the air density very low, of course. Both these factors may have influenced the observations with the Schlömelch electrolytic cell; laboratory experiments subsequently performed did not show any but a weak influence of these factors, however. The effect of distance or radiotelegraphic signals, rather than that of the height above sea level, was studied by W. Duddell and H. J. Taylor in 1905; by Tissot, and within the last years by Mosler, and especially by L. W. Austin, of the Bureau of Standards. The earlier experimenters were not able to study the effects of considerable distances. Austin used waves ranging in wave-length from 300 to 3,750 meters and distances up to 1,000 nautical miles, his stations being on land and on cruisers of the United States. As long as the distance did not exceed 100 or 200 miles, the intensity of the received currents would vary inversely, roughly, as the distance; at greater distances the intensity would fall off more rapidly; the night signals were stronger than day signals, but also often more irregular.—*Engineering*.

TUNGSTEN LAMPS OF HIGH EFFICIENCY.

Monthly Meeting of American Institute of Electrical Engineers.

The 286th meeting of the American Institute of Electrical Engineers was held in the Engineering Society Building, New York City, on the evening of October 10. President Mailloux occupied the chair and introduced the speaker of the evening, Irving Langmuir, who abstracted the two parts of the paper. The first part was entitled "Blackening of Tungsten Lamps and Methods of Preventing It." The second part, of which J. A. Orange was joint author, was entitled "Nitrogen-Filled Lamps."

Tungsten Lamps of High Efficiency.

The first part describes investigations into the cause of blackening of the bulbs of tungsten lamps and discusses methods whereby this effect is avoided and the efficiency of the lamp thereby increased. The second part describes in detail the high-efficiency tungsten lamps which have been produced by filling the bulbs with nitrogen vapor at approximately atmospheric pressure. The blackening of ordinary lamps has generally been considered due to the presence of residual gases which adhere to the surface of the glass or are occluded in the filament. These investigations show that of the residual gases, water vapor is the only one which causes perceptible blackening, by means of a cyclic process in which the water oxidizes the filament, the oxide is volatilized and deposited on the bulb, where it is reduced to metallic tungsten and the water vapor again formed. This action, however, is shown to occur only in poorly exhausted lamps and the real cause of blackening in well exhausted lamps is due to evaporation of the filament alone. The sources of residual gas in the bulb, filament, leading-in wires, anchors, and bulb were examined. Of these, the latter is the most important and seems to continue giving off gas, which is mostly water vapor, with successive rises in temperature. The presence of argon causes a large Edison effect and rapid blackening of the bulb. The methods of improving the efficiency of the tungsten lamp consist of the introduction of gas, such as nitrogen, or mercury vapor, into the bulb at atmospheric pressure and changing the location of the deposits by means of convection currents in the gases so that the glass opposite the filament is not darkened.

By making use of these principles, practical tungsten lamps have been produced having a life of over 2,000 hours and an average specific consumption of one-half watt or less per candlepower. A number of different types of nitrogen-filled tungsten lamps are described in detail.

Three types of lamps are being made: (1) large units of high efficiency (0.4 to 0.5 watt per candle, 20 to 30 amperes, 1,500 hours of life) to be operated on alternating-current circuits with transformers; (2) small units of low voltage (0.6 to 1.0 watt per candle, 10 amperes or less, 1,000 hours of life) for series street lighting, stereopticon lamps, automobile headlights, etc.; (3) lamps to run on standard lighting circuits (0.5 watt per candle, 110 volts, several thousand candlepower). The nitrogen-filled lamps have the advantage of whiter color, since the filament is about 500 degrees hotter than in ordinary lamps, high intrinsic brilliancy (for projection work, headlights, etc.) and constancy of characteristics during life. The mean spherical candlepower averages 84 per cent of the maximum horizontal, according to which they are rated.

The discussion was opened by John B. Taylor, who pointed out the usefulness of a small filament of high intrinsic brilliancy for projection work and for color photography. The incandescent lamp has the great advantage for such work of a constant position for the source of light. He projected upon the screen an image of the filament of one of the new lamps and called attention to the fact that the inside of the helix was brighter than the outside. He inquired as to the resistance of the new lamps when hot and when cold, with reference to the effect of an immense overload produced by throwing the cold lamps suddenly upon the circuit, as experienced with present tungsten lamps. This would be accentuated in the new lamps and might prove serious.

John W. Howell, whom the president designated as the greatest authority in the world upon incandescent lamps, told of some of his experiences in incandescent-lamp work. While he had always believed that one form of blackening was due to evaporation of the filament, it had not been proven before. There are two other causes of blackening. One is due to defective vacuum and results in a mottled bulb. It is caused by air and the discoloration is brown rather than black. The third is water vapor. This cause has long been recognized and phosphoric anhydride has been used in exhausting since the early stages of the art. The water vapor did not blacken the carbon lamps so badly as the tungsten, however. He exhibited a tungsten lamp which had been burned only twelve hours, but which had previously had the bulb heated to drive off water vapor; the bulb was entirely covered with the black deposit. He called attention to the fact that small sizes of tungsten lamps make up 75 per cent of the output, and these do not fail by blackening but by breaking of the filament; so that evaporation is not what determines the useful life except in large sizes. Filling the bulbs with inert gases had been tried in the early days, but had not been found of any advantage with the thin filaments, or with carbon of any size.

J. E. Randall referred to the effect of the surrounding temperature on a 40-watt lamp, operated at 1.17 watts per candle. At ordinary room temperature the life is 1,000 hours; at 200 degrees centigrade it is 380 hours; at 240 degrees it is 228 hours; above 250 degrees it is less than 5 hours; operating at 0.96 watt per candle at 200 degrees it is 214 hours. Below 150 degrees no reduction in life was observed. These figures show what service may be expected from lamps used in ovens.

John W. Lieb, Jr., referred to the effect the new lamps would have on the central station, and said that the central stations are no longer apprehensive of any improvement in lamp making. He referred to the W. J. Hammer historical collection of incandescent lamps, which showed the complete development of the art, and which had been placed in the custody of the Association of Edison Illuminating Companies, and is on exhibit in the rooms of the American Institute of Electrical Engineers.

H. M. Fales called attention to the trouble produced on telephone lines by the humming of arc lamps, and expressed the hope that the new lamp would supplant the arc for street lighting.

After questions by Farley Osgood, William McClellan and M. G. Lloyd, Dr. Langmuir closed the discussion. He stated that the greater brilliancy of the interior of the helix was due to the fact that a cavity radiates like a black body, without any selective effect, rather than to its higher temperature, as the difference is only about 12 degrees. At the higher pressures argon can be used in the bulbs in place of nitrogen without bad effects, and if more readily obtainable, it would be used commercially. As to the effect of frequency, there is no perceptible flicker with the new lamp at 25 cycles. The exact pressure of the nitrogen in the bulb is not important and it is kept down to one atmosphere when hot so that the glass will not be thrown outward in case of breakage. The pressure when cold is less than one atmosphere. The field for the new lamp begins where the old lamps left off—at about 500 candlepower. There is no outlook at the present time for the small sizes.

More Pennsylvania Electrification.

In addition to the eletcrification of its suburban lines in the Philadelphia territory, it is announced that the Pennsylvania Railroad will extend the electrification out of New York City as far as Elizabeth, N. J. It is considered probable that the railroad will electrify its entire New York division within the next few years.

PHILADELPHIA MEETING OF AMERICAN INSTITUTE.

Electrical Engineers Hold Meeting on October 13.

The 287th meeting of the American Institute of Electrical Engineers was held in Philadelphia, Pa., on October 13. There were sessions in the afternoon and evening at Drexel Institute, with a dinner between.

A. R. Cheyney, chairman of the Philadelphia Section, under whose auspices the meeting was held, presided, and called the first session to order at 1:50 p. m. C. O. Mailloux, president of the Institute, was present and was called upon to speak. He first called attention to the presence of Past-president E. J. Houston, and then referred to the good work of the local section and the fact that the first electrical exposition was held in 1884 in Philadelphia.

On motion of H. A. Hornor, a vote of congratulation to President Mailloux was passed, with reference to his recent decoration by the French Government as a chevalier of the Legion of Honor.

Secretary Hutchinson was also called upon and made a brief address.

A paper entitled "Electric Drive in Machine Shops" was then presented by Charles Fair. It was illustrated with lantern slides.

Electric Drive in Machine Shops.

Two important questions before the manufacturer are to increase production and to decrease cost. Labor is the greatest cost of production, and where machine tools are a large factor the maximum output is necessary to keep down labor cost. Among the advantages of motor drive are maximum output; closer speed regulation; power distribution for cranes, lighting, etc., as well as for tools; elasticity in arrangement of tools; ease of rearranging tools and adding new ones; head room for cranes, hoists, etc.; facility for running single tools on overtime work; the elimination of belts and belt troubles; unobstructed light and sanitation; avoidance of well understood difficulties of lineshaft installations in concrete buildings. The general use of high-speed steel has made high cutting speeds necessary and this means more power. Slipping, due to a belt not being able to pull its cut, means waste power and a loss of production. In many cases it is not only more convenient but almost a necessity to apply the motor directly to the tool rather than to use the older scheme of belts with lineshafts or countershafts. The speed range of an adjustable-speed motor will in many cases cover the entire speed range of the tool. Wherever possible, direct drive should be used. This increases output and decreases the power required. Improvements in control appliances have kept pace with motor development and exacting requirements are now demanded and met. Magnetic control is coming into more general use.

Harold Goodwin opened the discussion by pointing out that the initial cost of instalation is much higher with individual drive, and often there is no advantage, as where a number of identical machines, such as looms, are driven almost continuously.

Charles Penrose said that individual drive is sometimes necessary to get proper individual operation of the machines.

A. J. Rowland inquired as to whether depreciation was greater with individual direct drive on account of the rigidity of the connection as compared with the flexibility of belts. Machines or work may sometimes be injured on account of such rigidity.

R. Louis Lloyd stated that initial expense is a vital question and often prevents the adoption of individual drive, even though it might be otherwise advantageous. One must decide which will be more economical in the end.

William Benson told of a textile mill which was partly steam-driven and partly electrically driven. The weavers were paid according to output and soon found they could earn about five per cent more on the electrically driven looms. The goods were also better. This factory is to be equipped electrically throughout.

H. C. Albrecht related some interesting points regarding plants which had been won over to electric drive.

C. O. Mailloux mentioned the wide adoption of electric drive in Continental Europe, where managers are very careful regarding investment and amortization. Belt drive has disappeared almost entirely. He mentioned a number of cases to show how completely electric drive had been adopted there.

In closing the discussion, Mr. Fair said that an ideal equipment would involve both direct and alternating current, the former being needed for adjustable speed; and both group and individual drive, depending upon the character of the machines. In many places belts are out of the question, as where synchronism of different parts is required. Belt slip sometimes reduces speed enough to seriously curtail output. For many small machines it is not necessary nor advisable to have individual motors. For automatic machines in general he preferred direct-connected individual motors. Changing over one screw machine increased the output about 50 per cent. In textile mills, cleanliness and increased output are important considerations. For high speeds he preferred herringbone gears to rawhide, and it is only the cost of the former which prevents their wide adoption. Regarding injuries resulting from a positive drive, he thought there should be automatic means for stopping a motor before damage was done.

H. P. Liversidge presented a paper entitled "Industrial Substations." This also was illustrated with lantern slides.

Industrial Substations.

The author traced briefly the engineering development of "industrial substations," by which term he designated installations of electrical equipment in consumers' premises, receiving electrical energy from a central-station system for distribution. A discussion was entered into of the factors governing the design and installation of this class of substation and four factors were advanced as determining the design: (1) space economy; (2) operating requirements; (3) fire hazard and safety to attendants; and (4) costs.

Descriptions were given of twelve industrial substations which were taken as typical installations and which are at present in operation in this country. The customers supplied represent a silk mill, two grain elevators, ship and engine building, amusement park, car manufacturing, paper factory, type foundry, rubber goods, cold-storage plant, garage and pumping station. Numerous diagrams and illustrations were given of the various plants. At the conclusion of the descriptions, detailed discussion was undertaken in a further analysis of the four factors enumerated as they relate to the twelve plants which had been described.

W. C. L. Eglin opened the discussion, expressing the opinion that too much attention was given to space economy in the design of such substations, and often there is not sufficient room, especially where the apparatus is static and not rotary. Since real estate and building costs are small items, there is no excuse for crowding. He did not favor the complete inclosure of high-tension apparatus, but preferred transparent partitions or small openings to assist in locating trouble. The objectionableness of water is usually overrated, and all apparatus should be designed for complete immersion.

Mr. Brooks questioned the advisability of installing two complete banks of transformers, even for 24-hour service, since a single spare transformer would be sufficient in case of breakdown. He also considered a single instrument sufficient to use with different instrument transformers.

Mr. Stevens referred to the idea of designing a substation for continuity of service, which is of prime importance to certain power users. This consideration sometimes makes them willing to pay a little more for power of their own generation. If there were greater certainty on this point they would be more willing

to use central-station service. Where possible, there should be two feeders to a customer, and a two-bus system should be used, with two-way switches. This is more flexible and makes less possibility of interruption to service. A shipyard where repairs are made in drydock is an example where work is kept up day and night and an interruption is very expensive. A substation with above provisions has been in operation for six years without a shutdown, although there would have been several but for the two-bus system.

Charles Penrose preferred sectionalizing a single bus to two busses, on account of the initial cost. With the securing of large customers, the industrial substation became comparable to the central-station substation, and involved equal problems of design. There are usually greater limitations to the former, however, as evidenced in the paper.

Harold Goodwin recognized the importance of continuity of service in some cases, while in others the cost of providing reliability was not warranted, and the customer was not willing to pay for it. The value of continuity was hard to decide in general. The cost of power is usually a small item in the total cost of operating a factory. In a silk mill it might be only 2 or 3 per cent, although in such a case as a grain elevator much higher than this.

Mr. Holdrege said that in Baltimore there were industrial substations in sizes from 250 to 6,000 kilowatts, the total amounting to 15,000 kilowatts, at 13,000 volts, 25 cycles, three-phase. The yearly consumption amounts to over 50,000,000 kilowatt-hours. Continuity of service was of paramount importance in all cases, and a spare transformer is provided and can be quickly thrown into service. Maximum demand is usually determined by a graphic wattmeter giving a continuous load curve. An hourly or half-hourly integrated peak is used, the bill being based upon the five highest peaks per month. In some cases a printometer is used in connection with a watt-hour meter, but it is not so well suited to large customers, on account of a large multiplying constant.

P. M. Lincoln and John Matthews also spoke.

In closing the discussion Mr. Liversidge agreed with Mr. Eglin as to space economy and favored more space, but it is often hard to get more than the minimum, because the buildings are already erected and an out-of-the-way corner must be utilized. In answer to a question he said the three-wattmeter method of measuring power has been found more satisfactory and reliable in some cases than two. The central station can guarantee continuous service under almost any conditions, and the substation should be built so that it will not break down. Then two busses are unnecessary, but the bus may be sectionalized if desired. All the stations described in the paper do not represent the most modern practice, but they are illustrative of what has been installed.

This discussion was interrupted for the purpose of inspecting the laboratories and shops of the Drexel Institute and the University of Pennsylvania, introductory remarks being first made by Profs. A. J. Rowland, Thomas Smith and W. E. S. Temple.

At 6:30 p. m. dinner was served at the Normandie Hotel. President Mailloux spoke at the conclusion regarding the International Electrical Congress to be held in San Francisco in 1915, asking the support of the Philadelphia Section in the making of arrangements and furthering the success of the Congress.

Discussion of papers was resumed at Drexel Institute at 9 p. m., and Paul M. Lincoln presented his paper on "Relation of Plant Size to Power Cost."

Relation of Plant Size to Power Cost.

The author gave three principal reasons why a central-station plant can take care of a given service more economically than a small plant. First, because the first cost per kilowatt of the large units is lower than the corresponding cost of the small units, thereby reducing the first cost and the annual fixed charges. Second, because the operating cost of a large plant is proportionally less than that of a small plant, and because the large plant can afford to make use of labor-saving and other devices which would be out of the question in a small plant. Third, because of the existence of a diversity-factor whereby a combined load can be operated with a smaller total capacity than would be required if each part of the combined load were operated separately. These three factors are discussed at some length.

In spite of lower cost in generating power, there are two arguments that may be urged against central-station supply. The necessity for a transmitting and distributing system involves additional first cost, upkeep and operating losses, but these do not amount to enough to offset the advantages. The second argument in favor of the isolated plant is that the same steam may be used for heating and for power generation. In general, the advantages of the central station will also outweigh this consideration. No heat is required during more than one-half of the year and there is also an undesirable daily diversity between heat and power requirements.

The author concluded that the only reasons why central stations should not supply all the electrical service within their territory are that the rates offered may be out of proportion to the cost of the service, or that the customer may have some motive other than the cost of the supply for not using central-station service.

H. A. Hornor opened the discussion, endeavoring to present the motives of the isolated-plant owner in operating his own plant. The arguments as to the cost of power are admitted, but other conditions are determining, and the heating question is one of the smallest of these. Steam is often required in the processes of manufacturing, although sometimes a substitute could be used. The problem is one of commercial economics, rather than engineering. In considering costs, the central-station man is prone to estimate them too high, and the owner too low. A concern often manufactures different kinds of power, and it is very hard to determine the cost of each kind. His own company uses four kinds: steam, electric, pneumatic and hydraulic. He gave some of the details of this plant, and pointed out the problems involved in adopting central-station service. The central station must first prove an advantage. When it gets an off-peak load, it can reduce the cost; but when additional generating equipment will be required, as for supplying an electrified railroad, it is a question whether there is any economy. Summing up the situation, he said that any new plant should plan so as to be able to introduce central-station service when it is shown to be advantageous, that old plants must be convinced of such advantage, that the principal motive for retaining isolated plants is due to commercial economics, and that the central station will eventually supplant the isolated station.

W. C. L. Eglin introduced, as a fourth reason for the more economical generation of power in the large central plant, the effect of depreciation and obsolescence. Economy of operation decreases with age, especially in steam plant, although the owner usually believes that he is operating at the original efficiency. The central station displaces old and inefficient apparatus, as illustrated by the fact that turbines have largely replaced reciprocating engines, whereas the private plant only does so when the plant has become too small. Personal inertia is another reason for retaining the inefficient, as illustrated by the fact that there are still three times as many carbon-filament lamps in use as there are tungsten, and it will probably take 3 to 5 years to eliminate the former. In Europe the tungsten lamps are more generally used. It is only a question of time until central-station service becomes universal. Change is retarded by the necessity for scrapping old plant.

C. O. Mailloux considered that Mr. Lincoln had covered the general case, but his conclusions would have to be modified in special cases. He referred to an experience of 25 years in which he had reported upon hundreds of cases after thorough study, with sometimes one result, sometimes the other. There are some instances

where the central station has no chance. One of these was a sugar refinery where large quantities of steam were required for the vacuum pans for evaporating. There was consequently a large boiler capacity, and the small percentage of the heat of the steam taken in generating power made the cost of the latter very slight. After using 2,000 horsepower in addition to lighting the buildings, there was still surplus power, which was used in the first electrical cooking installation in the world, serving 150 people. There are other cases not so exaggerated where the balance is still in favor of the isolated plant, while in many cases the reverse is true. The importance of the increasing size of units is overestimated, since the cost of delivery is greater than the cost of generation. Further reductions in generating cost cannot have much effect, since central-station costs approach a limit between 3 and 4 cents per kilowatt-hour. A change may come from improvements in lighting, which will reduce the lighting peak, and make it possible to sell current for lighting at much lower rates.

M. G. Lloyd thought the argument for lower generating costs in the larger plant could not be refuted, but the central-station problem does not end here. If so, it would be easy. The investment in distributing plant may be as great as in generating plant, and distributing cost must be considered before the argument for lower central-station cost is complete. The element of heating, too, is less favorable than would appear from the paper, since in some localities, heating is necessary for eight months of the year.

J. P. Jackson praised the method of presentation of the subject. He thought the average plant owner sees only dimly the fact of obsolescence.

G. J. Blum favored an intermediate course between the isolated plant and the large central plant covering a wide territory. The plant of intermediate size can keep down the costs of both generation and distribution, and it is practical for it to supply steam for heating.

H. C. Albrecht said that the central station could duplicate plant for reliability, and the fact of the frequent supply of emergency service demonstrates that it is more reliable than the isolated plant.

In closing, Mr. Lincoln said that the necessity for showing a saving where an existing plant must be abandoned was the greatest obstacle to introducing central-station service. In answer to a question as to the status of oil and gas engines in influencing cost, he said that the scarcity of such plants was a sufficient answer. As to heating, there is only a short period when the maximum heating is required, and at other times steam must be generated for power only. He admitted that distributing cost constituted a large part of fixed charges, but only a small part of operating charges.

George A. Hoadley then spoke in appreciation of the presence of the Institute officials at the meeting and moved a vote of thanks to Professor Rowland and to the officials of the Drexel Institute and the University of Pennsylvania for courtesies extended. This was carried and the meeting adjourned.

Commonwealth Edison Section, N. E. L. A.

At a well attended meeting of the Commonwealth Edison Section, N. E. L. A., held in Association Auditorium, on the evening of October 14, two papers dealing with the operating side of the central-station industry were read. The first under the title "Latest Types of Converting Centers for Lighting, Power and Railway Service," was presented by B. G. Jamieson, assistant to electrical engineer, and the second, "The Distribution System and the Cost of Electric Service," was read by H. B. Gear, engineer of distribution.

Mr. Jamieson described a type of substation original with Chicago; that is the station located in the subbasement or the sub-subbasement, some 30 or 35 feet below the city datum line. The substation just under the sidewalk is a disappearing type. The value of this space has forced it into a lower basement. Several of these subbasement equipments were shown by stereopticon slides.

One of the largest of these subbasement substations, that known as the Sherman Street station is notable both on account of its capacity, 11,500 kilowatts with a possible output of 16,000, and because of its unusual accessibility. The design with its raised floor, permits unusual battery space, and insures the machinery against immersion, even in unusual flood conditions.

Mr. Jamieson urged on his hearers the advantage of becoming better acquainted with these inconspicuous subbasement stations.

Mr. Gear, in his paper, took up briefly the cost of generating and distributing power, analyzing the elements of expense. He spoke of the desirability of the various loads, and the necessity of securing good diversity-factor, through service to ice plants, garages and so on. The paper was illustrated by numerous diagrams.

At this meeting the officers of the Section for the coming year were announced as follows: President F. J. Arnold; vice-president, P. J. Smith; secretary, T. J. Walsh.

Mr. Abbott, who presided at the meeting read a letter from T. C. Martin, advising the section of the three cash prizes to be awarded for the best ten "reasons why" membership in the section as desirable. These prizes are: first $25.00; second, $15.00 and third $10.00. The contest closes December 1.

SPEED REGULATION OF MOTOR-DRIVEN CENTRIFUGAL BLOWERS.

By H. F. Stratton.

This article purports merely to be a fiscal investigation of the speed regulation of direct-current motor-driven centrifugal blowers, first by armature control, and second by field control.

The curves employed herewith, and the statements made, relate only to centrifugal blowers operated by 220-volt direct-current motors in which the amount of air delivered is varied by changing the speed of the motor, and not by changing the outlet of the blower. Under such conditions the horsepower required to drive the centrifugal fan varies quite closely as the cube of its speed, and the necessary torque as the square of its speed. If the motor is controlled by the use of resistance in series with the armature, the current flowing through the motor, which varies as the torque, must therefore vary as the square of the speed. It therefore follows that the power drawn from the line, which is merely the product of the volts and the amperes, varies as the square of the speed.

Since the motor develops horsepower as the cube of the speed, but since the motor and resistance take power from the line as the square of the speed, the difference of these two is the power wasted in the external resistance. In other words, the power dissipated as heat in the external regulating resistance varies as the square of the speed minus the cube of the speed.

In Fig. 1 speed is indicated decimally as fractions of normal speed, and horsepower is indicated decimally as fractions of the total horsepower developed when the motor is running without any resistance in series with the armature. In this figure, curve A indicates the power drawn from the line at various speeds, and curve B represents the horsepower developed by the motor at various speeds. Curve C is the difference between curve A and curve B, or, in other words, is the power wasted in the resistance. For instance, at 0.5 speed the power drawn from the line is 0.25 of the normal horsepower of the motor. The horsepower developed by the motor at this speed is 0.125 of the normal horsepower of the motor, and the power wasted in the resistance is the same as the power developed in the motor.

If, as an equation, we say that $A=S^2$ and $B=S^3$, then $C=S^2-S^3$, and is so plotted, S in this case representing motor speed.

As an interesting development, if the differential of C be taken and equated to zero, it is found that C is a maximum when S is 0.667. In other words, the

power lost by armature control is largest in watts when the motor is running at two-thirds of normal speed, and this maximum waste of power is 0.125 of the horsepower developed by the motor when running at normal speed. It is, however, one-third of the power drawn from the line when running at this speed.

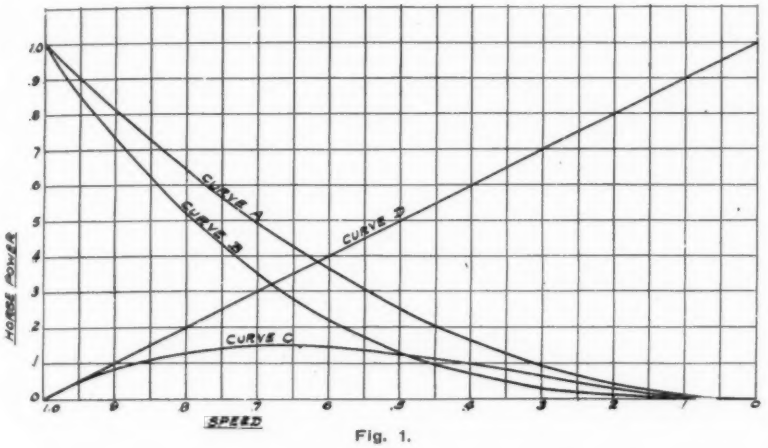


Fig. 1.

Curve D is the ratio of power wasted, to power drawn from the line at different speeds, or it can be expressed as $(S^2-S^3)/S^2=1-S$. Curve D is plotted from this equation, and shows that, from zero at full speed, the percentage waste of power increases in direct proportion as the speed decreases, until theoretically, at zero speed, all power is wasted.

Now as to the practical application. If some approximation can be assumed as to the amount of time at which the motor runs at some speed below normal, it is then very easy to estimate how much horsepower is wasted. As a concrete example, suppose a 20-horsepower motor runs 300 days a year and 20 hours a day, which is 6,000 hours per year. Suppose half of the time its speed is choked down to between 0.9 and 0.8 of normal, which means that for 3,000 hours per year 0.1 of 20 horsepower, or 2 horsepower, is wasted in external resistance. This makes 6,000 horsepower-hours per year, which, figured at a cost of $0.015 per horsepower-hour, establishes a yearly monetary loss in power wasted of $90.00.

If, on the other hand, we consider the use of an adjustable-speed motor with field control, the added expense in this instance is the interest and depreciation on the extra cost of the more expensive motor.

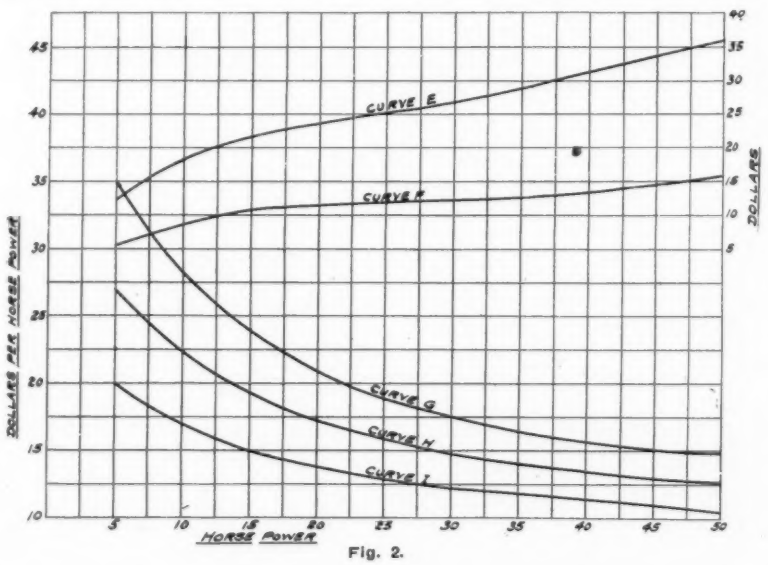


Fig. 2.

Fig. 2 deals with this matter, and curves G, H and I show respectively the cost in dollars per horsepower of motors of the following characteristics: in the case of curve G, an adjustable-speed motor, 2:1 speed range; in the case of curve H, an adjustable-speed motor, 1.5:1 speed range; in the case of curve I, a constant-speed motor, wherein speed regulation must be obtained by armature control.

It should be noted parenthetically that these curves showing the cost of the different motors of different sizes merely represent the average costs obtained from several large manufacturers of such motors. The curves do not represent any particular line of motors, but merely an average between several sets of figures.

These three curves then give us the added extra cost for different sizes of motors if we should employ (1) an adjustable-speed motor having a speed range of 2:1, instead of a constant-speed motor with armature control; and (2) if we should employ an adjustable-speed motor with a speed range of 1.5:1, instead of a constant-speed motor with armature control.

If we take the total difference in costs of the different motors, and to this difference apply depreciation at 10 per cent and interest at 6 per cent, curve E then shows what the interest and depreciation charges would be for different sizes of motors if an adjustable-speed motor, 2:1 speed range, be used instead of a constant-speed motor, and curve F shows the interest and depreciation charges if an adjustable-speed motor, speed range 1.5:1, be used instead of a constant-speed motor.

Coming back to the case of the 20-horsepower motor which we considered originally, and where it developed that the power lost cost $90 a year, if we run up from 20 horsepower to curve E we find that the interest and depreciation charges on a motor having a 2:1 speed range by field control are $23 annually, and if we run up to curve F we find that the interest and depreciation charges on a motor with a speed range of 1.5:1 by field control are about $12 annually.

From these figures, and others which can be made on typical cases, it develops that it is generally more economical to regulate the speed of motor-driven centrifugal blowers by field control than it is by armature control.

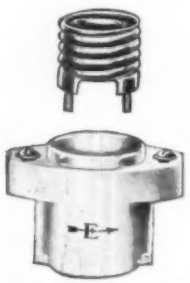
New 100,000-Kilowatt Plant for Manchester.

Manchester municipality, which has long been noted for the rapid growth of its electrical system, is faced with an urgent need for big extensions. Stuart Street and Dickenson Street stations must, according to present plans, be supplemented by a third and bigger plant for which an 11-acre site is to be secured at Trafford Park on the Manchester Ship Canal. Here a beginning will be made with 25,000 kilowatts, further additions being made as needed up to 100,000 kilowatts which, it is estimated, will suffice until the year 1919. By building the station on the canal something like $85,000 per annum will be saved on coal cartage water.

New Electrical and Mechanical Appliances

Separable Sign Receptacle.

The Arrow Electric Company, Hartford, Conn., has originated a new feature in sign receptacles by making the screw shell which holds the lamp removable from the front of the receptacle, without disturbing any other parts. This feature is illustrated in the accompanying illustration. In this new type of receptacle the screw shell may, therefore, be replaced if necessary without removing the receptacle from the sign. This valuable feature has also been applied to all weatherproof outlet-box receptacles manufactured by the company.



Arrow Separable Sign Receptacle.

The Eichhoff Combined Take-Up and Pay-Out Wire Reels.

It has been the custom of telephone, telegraph and other electric utility companies making use of overhead line circuits to provide their construction gangs with separate reels for paying out and taking up wire. In order to save time and labor in this work there has been placed on the market by Mathias Klein & Sons, 652 West Van Buren Street, Chicago, the Eichhoff combined take-up and pay-out wire reel. These combination reels fulfill both these requirements and perform their work better and in less time than the old-fashioned individual reels.

Fig. 1 is a view of the simplest form of these reels. It will be observed that it is mounted upon a framework with convenient handles at each end for readily carrying it from place to place. The reel disk is made of No. 10 galvanized sheet steel; it is 34 inches in diameter and has a one-inch flange turned over its edge for stiffening and also for giving a smooth edge. The disk has no spokes or projecting rim to cut through insulation or the copper or galvanized coating of wire. It also serves excellently for coiling up barbed wire.

Fig. 2 shows the method of taking up wire. The outfit is set up on end and readily secured to any convenient pole, fence or other structure. An adjustable wire guide is provided and the entire operation is so simple that one man can readily coil up wire without assistance. A contrasting view is shown in Fig. 3 which depicts the old way of doing this work, which usually involved something like five men.

The reel has a brake about the hub which can be adjusted to operate at any desired tension. There is also a stop pin which holds the reel disk stationary at any point. The arms of the reel are adjustable so that a coil of wire can be readily removed from the reel without trouble. The reel axle is made of seven-eighths-inch cold-rolled steel, with a cast-iron hub bored to fit it. The weight of the reel is about 80 pounds.

The Eichhoff reel is also made with two light wheels beneath the framework, so that it can be readily wheeled from place to place by one man. Another form of this reel is mounted on an upright in such a way that it can be used in either vertical or horizontal position. This form is particularly designed for use on an automobile, truck or wagon, in which case the mounting is bolted to the vehicle. A number of reels can be attached to the sides of an ordinary truck and being bolted to the sides they leave the middle of the truck open so as to give plenty of room for the linemen's tools and supplies.

Fig. 1.—Eichhoff Combined Take-Up and Pay-Out Reel.

Fig. 2.—One Man Taking Up Wire With the Eichhoff Reel.

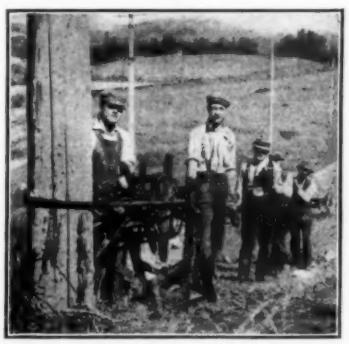


Fig. 3.—The Old Way in Which Five Men Were Frequently Required.

Cutter Idealite Fixtures.

In all industrial lighting effectiveness as well as efficiency are prime requisites. Effectiveness involves furnishing adequate light both as to intensity

and distribution, and efficiency is cared for nowadays by using single-unit tungsten fixtures. Such fixtures almost invariably involve the use of appropriate reflectors or shades, serving both to throw the light downward upon the working plane and also to more or less screen the lamp itself. In the design of nearly all reflectors it is contemplated to use a particular size of lamp placed in a particular position in the reflector, because otherwise the distribution aimed at by the designer will not be achieved. In many cases, however, it is found that after an installation has been completed insufficient light is provided in some parts of a room or over some machines or areas requiring close visual work. To provide additional illumination with the ordinary reflectors means replacing both the reflector and the lamp with a larger unit. Again, the distribution provided by a reflector frequently is not that best suited after some change in the nature of the work has been made; it is frequently desired to either restrict the illuminated area or to increase it, and this can be done only, when an ordinary reflector is used, by changing the reflector.

These two restrictions in the use of reflectors have greatly limited their application, or when not properly observed they have produced poor illumination. To overcome these difficulties there has been placed on the market by the George Cutter Company, South Bend, Ind., a line of fixtures termed the Idealite fixtures. Embodied in these are some unique features which will be made clear by inspection of Fig. 1. Most distinctive of these features is that the lamp socket is not rigidly fixed in the reflector but by an ingenious arrangement can be moved upwards or downwards, so as to secure exactly that distribution which the requirements demand. This same arrangement also permits changing the size of the lamp and adjusting the socket in accordance therewith to provide the distribution desired. The sockets used are suspended from the body of the fixture by three adjustable screws. On these screws are six spiral springs that actually support the socket and thereby the lamp. In this way the socket can be readily moved up and down and the springs at the same time serve to guard the lamp from vibration. About the socket is a brass shell, the lower portion of which also serves as a shade holder. With these fixtures any desired type of reflector may be used, whether of glass, enameled-steel or aluminumized steel, and also whether providing for broad or concentrated distribution.

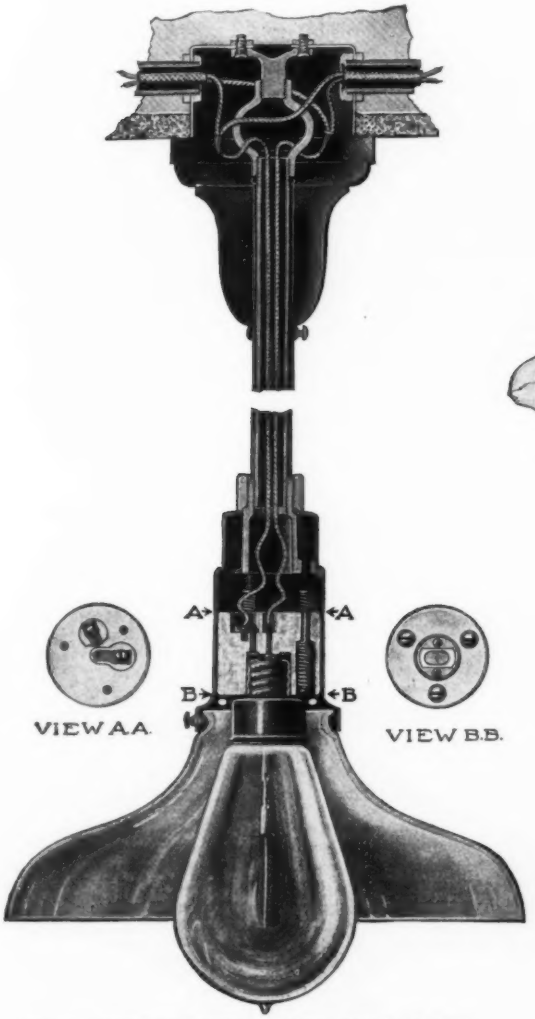


Fig. 1.—Sectional Views of Cutter Idealite Fixture.

Fig. 2.—Chain Fixture.

Fig. 3.—Stem Fixture.

The fixtures are made in a variety of forms with rigid stem or chain suspension. Figs. 2 and 3 show these two types. In all cases there is provided a porcelain socket with wire terminals for connecting the leading-in wires, so as to avoid a splice in the fixture body. The stem-type fixtures are wired with an extra heavily insulated No. 16 fixture wire, having a 30-per-cent-pure Para-rubber insulation; this eliminates the need of insulating joints and of lined canopies when the fixtures are connected to conduit work.

Special Control Equipment to Provide Safety Insurance in Elevator Service.

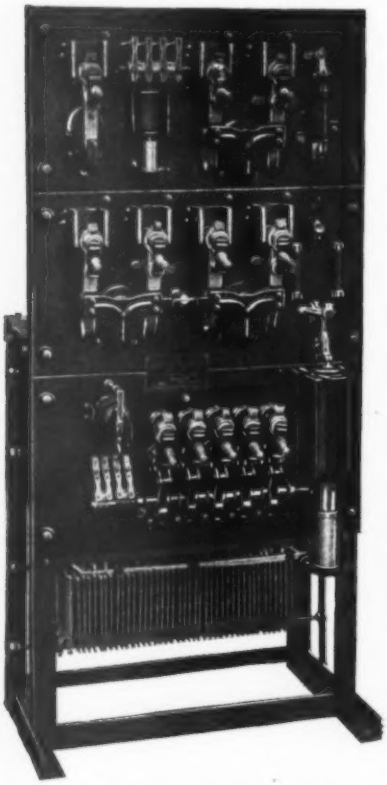
Because of the fact that so many people make daily use of elevators the choice of elevator control equipment is now given the greatest consideration to insure the maximum safety. In the design of what is known as the Cutler-Hammer Bulletin 7,560 type full magnetic elevator controller the control system is laid out so that even should grounds or short-circuits occur in the cables or switches, no damage to the elevator or its occupants can result. Failure of any part of the equipment to function properly results in the slowing down of the elevator and bringing it to a stop. The latest design of controller, the panel of which is shown in the illustration on the next page, permits of all the refinements of control that can be used in connection with direct-current motors.

These standard controllers built by the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., are furnished in either single-speed or two-speed types, both types being equipped with the slow-down feature. The single-speed types are used with motors that have no field control. The two-speed controllers are used with motors having additional speed variation by means of shunt-field resistance. The slow-down feature is obtained in both cases by means of the combination of armature series and shunt resistance.

The armature shunt resistance is used also for dynamic braking.

Single-speed equipments are generally used for moderate-speed elevators, while standard two-speed controllers are used with elevators operating at high speeds and this particular design of controller can be arranged for use with the very highest speed elevators possible.

The magnetic switches mounted on the slate control panel are simple and rugged in construction and can easily be taken apart for inspection or for renewal of the contacts. All switch arms have a channel section and the other parts are heavily ribbed where required so as to eliminate the breakage of any of these parts.



New Cutler-Hammer Elevator Controller.

All electrical contacts on these panels are of the butt type, carbon to copper. These contacts have a wide range of adjustment for taking up wear, thus insuring maximum life. Dust and dirt cannot collect on the contacts because they are vertical.

The main contacts are equipped with magnetic blowouts, the blowout coil being of bar-wound copper mounted on the back of the control panel, so that these coils cannot burn out nor be damaged from the arc itself. All of the wiring is exposed on the back of the panel and all terminals are accessible.

A double-pole main-line switch breaks both sides of the line and in connection with the direction switches gives four breaks in the armature circuit. The direction switches are mechanically interlocked to prevent their simultaneous operation which would cause a short-circuit on the line. These switches will automatically open on abnormal voltage drop and stop the car.

A double-coil overload movement is arranged to stop the elevator in case of overload and can be automatically reset by throwing the car switch to the off position. This gives a reliable indication as to whether the car is overloaded and by having the resetting feature in the car switch, it is possible to set this overload within the closest limits. This device therefore possesses an advantage over the hand-operated circuit-breaker in that the operator is not compelled to go to the switchboard in case a slight overload occurs. The only thing necessary is to lighten the load on the elevator. With a manually operated circuit-breaker the operator, under these conditions, invariably increases the current setting of the breaker when he goes to the panel to reset it and, in case of continued tripping, eventually ties the breaker in, thus eliminating the overload protection which the circuit-breaker is designed to give. Besides the main controller panel and the car switch, all the electrical accessories required for the control of electric elevators are made by the Cutler-Hammer Company.

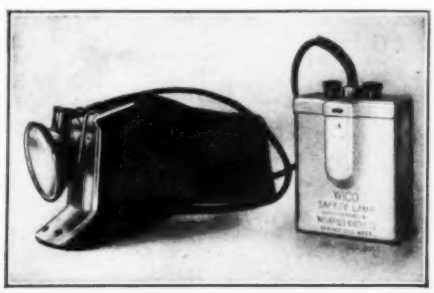
Miner Equipped With Wico Safety Lamp.

Electric clocks are to be placed in the new Montreal City Hall annex. $2,715 is to be appropriated for the purchase of 68 timepieces.

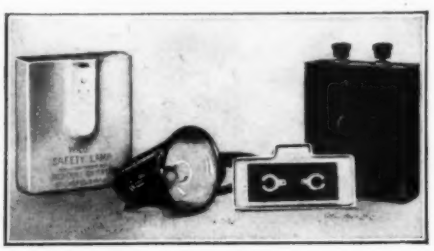
The Wico Permissible Electric Safety Lamp.

The problem of producing a practical electric safety lamp, light enough to be readily carried by the miner, durable enough to stand the hard usage of mine work, and perfectly safe in highly explosive gaseous surroundings, has occupied the attention of electricians for many years. It is a matter of satisfaction and importance to mine owners and the men engaged in work in the mines that lamps are now being produced which meet with the approval of the United States Bureau of Mines, fulfilling its rigid requirements.

The United States Bureau of Mines has recently issued its approval to the Witherbee Igniter Company, of Springfield, Mass., for the Wico electric safety lamp as "a permissible cap lamp for use in gaseous mines," after a most exhaustive test of 40 lamps at the Pittsburgh laboratories of the Bureau of Mines. Herewith are shown illustrations of this novel and interesting improvement in safety lamps.



Wico Permissible Electric Safety Lamp, Showing Method of Attachment to Cap and Flexible Connection to Storage Battery.



Wico Lamp and Battery Removed from Case.

The success of the Wico lamp was made possible by two very ingenious and novel features. First, a venting system which permits the use of a liquid acid battery, which is made perfectly non-spillable; next, by the arrangement of the lamp bulb which instantly breaks the circuit and extinguishes the glowing filament if the bulb is fractured.

The venting is accomplished by an ingenious arrangement of glass tubes imbedded in the compound which seals the acid chamber. These tubes are so arranged that in any position of the battery the acid chamber is vented and still no

acid can possibly be spilled. This is a matter of special importance as the battery is carried on the belt and even a small amount of leakage would destroy the casing of the battery, and burn the clothing and skin of the miner. The use of paste electrolyte, on other the hand, materially reduces the capacity, thereby increasing the necessary weight of the battery for the desired hours of light.

The safety-bulb attachment is of great simplicity and efficiency. The bulb is held in place against two spring contacts by a wire bail passing over the top of the bulb. One of these contacts is longer than the other. When the bulb is broken the longer contact breaks the circuit with the short one; this immediately extinguishes the glowing filament and any spark made by breaking the circuit is in an inclosed tube which cannot possibly have been reached by the explosive gases. This tube, or lamp socket, is made of a one-piece, drawn seamless steel tube affording protection to the base of the lamp bulb and preventing any possible jamming and the consequent failure of the safety device to act. As an additional safety precaution the maximum discharge rate of the battery on direct short-circuit is so low in amperage that it will not explode gas.

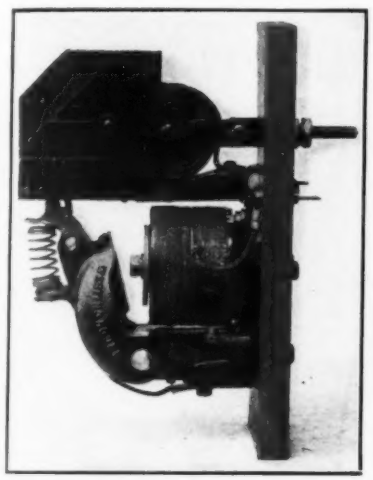
In the Wico lamp not only have these essential problems been solved, but every detail has been carefully worked out after several years of experimental work and practical tests of the lamp in actual mining conditions. The lamps are now in use in the mines of the Philadelphia & Reading Coal & Iron Company, and other large producers in the anthracite field; the mines of the Canadian Pacific Railway in Alberta and are rapidly being introduced into other mining districts throughout the world.

Aside from the question of safety, it is found in practical use that these lamps are very efficient and more economical than the ordinary oil lamp or miner's torch. The lamp is guaranteed to give twelve hours' continuous light on one charge daily for one year. It is found in practice that is requires but about two kilowatts to fully charge 100 batteries.

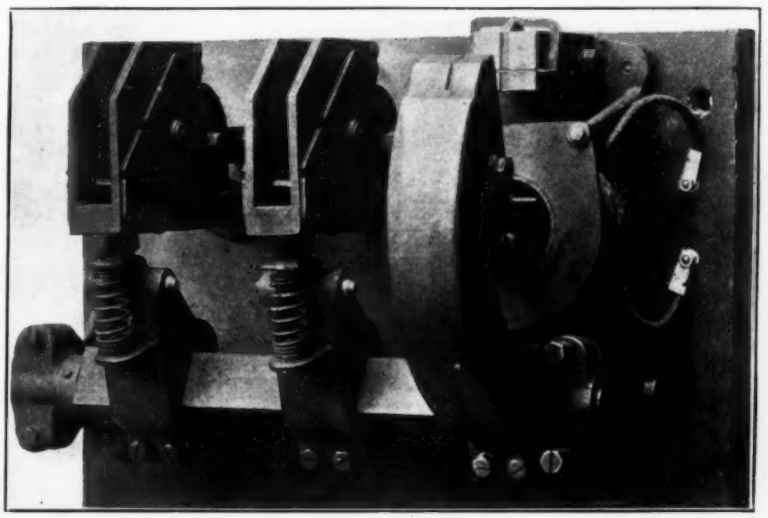
The frosted reflector of the Wico cap lamp gives a smooth, well diffused light, beneficial to the eyes. The old-fashioned oil torch, with its flickering inadequate flame is known to be responsible for a great deal of eye trouble. Then, too, the smoke from oil torches befouls the air and is not only an added discomfort, but an injury to health.

New Westinghouse Magnet Switches.

The new Westinghouse direct-current and alternating-current magnet switches for automatic controllers, which have just been put on the market, present a number of interesting features, many of which are novel. These switches have been designed especially with a view to obtaining continuity of operation for the controller on which they are used, so that every effort has been made not only to secure long life to the wearing parts but also to insure rapid repairs in case of accident.



Side View of Direct-Current Magnet Switch.



Two-Pole, 250-Ampere, Alternating-Current Magnet Switch.

The switches are of the clapper type and are arranged so that they are opened by gravity assisted by a spring. Direct-current switches are single-pole; alternating switches are two-pole and can be supplied with three poles when desired. Direct-current switches are made in both shunt and series forms.

Each switch is mounted on an individual slate base so that in case of accident an injured switch can be replaced immediately. The wearing parts, such as contacts, arc shields, etc., are in general the same in both alternating-current and direct-current switches of the same capacity, thus reducing to a minimum the number of repair parts to be carried in stock by firms using both kinds.

Special care has been taken to reduce the destructive action of the arc to a minimum. The arc when formed is not blown sidewise against the arc shield but is guided upwards by an arcing horn and is then extinguished by the blow-out coil. This arrangement preserves both contacts and arc shields.

The contacts, in closing, have first a wiping action, then roll against each other, and are finally firmly pressed together. In switches of 250-ampere capacity and larger the circuit is made and broken between copper and carbon, but in all cases the final contact is between copper pieces.

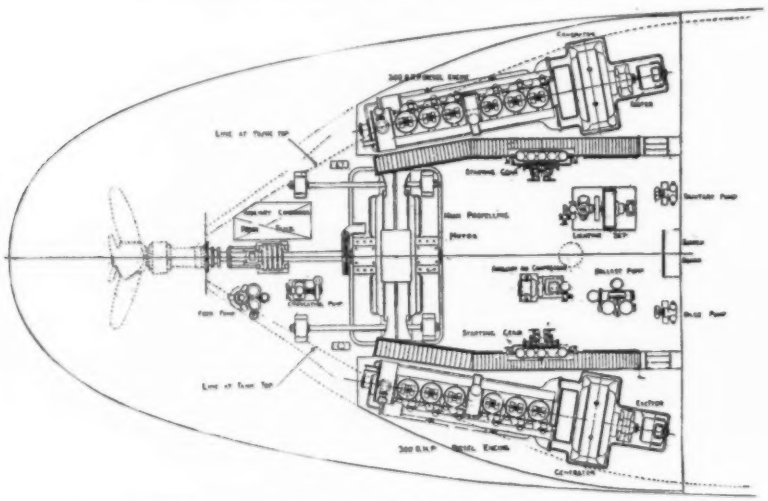
The flexible copper shunts which carry the current to the movable contacts are welded to the terminals; there is no solder to melt, run down the shunt and stiffen it on solidifying.

The New Electric Ship "Tynemount."

A party of electrical engineers recently paid a visit to the electrically propelled vessel *Tynemount* which has been built in England to the order of the Montreal Transport Company for service on the Canadian lakes and canals, where locks are numerous and necessitate frequent and rapid starting and stopping and control. The electrical system adopted by Mavor and Coulson is employed. This was fully described in a paper read at last year's convention of the British Association for the Advancement of Science, by H. A. Mavor, and again this year at a meeting of the Institute of Naval Architects.

The overall length of the vessel is 256 feet; length between perpendiculars 250 feet; extreme breadth 42 feet 6 inches; depth (molded) 19 feet; speed 9 knots. The vessel is designed for carrying about 2,400 tons dead weight of cargo, fuel, fresh water and stores, on 14 feet mean draft in fresh water. She has a single propellor direct coupled to a three-phase squirrel-cage motor. The speed is 78 revolutions per minute. There are two generators each 235 kilovolt-amperes, 500 volts, each driven by a Diesel oil engine of 300 horsepower working on the four-cycle principle. The engines have each six cylinders 12 inches diameter, stroke 13.5 inches and speed 400 revolutions per minute. Two steam boilers, oil-fired, are provided for working the deck equipment, steering gear, electric light set and for supply of heat to living quarters.

The following is from Mr. Mavor's description of the electrical equipment.



Plan of Stern Part of Ship, Showing Arrangement of Machinery.

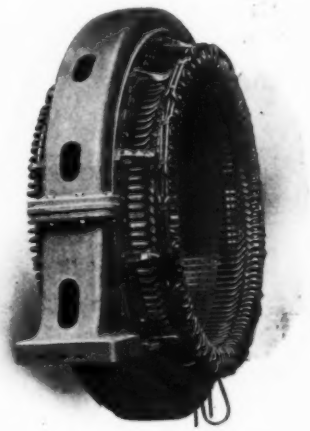
The two generators have six and eight poles, respectively, giving frequencies of 20 and 26.6 cycles. Connected to the shaft of each generator is an exciter, which, in normal working, gives about 30 amperes at 100 volts, but is capable of a considerable overload. A single three-phase motor is coupled direct to the propeller shaft. This motor develops 500 shaft horsepower. The rotor is of the simple squirrel-cage type without any electrical or mechanical connections other than its rigid attachment to the propeller shaft. The stator has two separate windings, for 30 and 40 poles, respectively. The windings are mutually non-inductive, so that, except for slight possible leakage of magnetism, they exercise no influence whatever on one another, and operate independently on the magnetic circuit of the motor. When each of these two windings is connected respectively to the appropriate generator the synchronous speed due to each is 80 revolutions per minute, or actually about 78 revolutions per minute when at full speed. By changing the connections the direction of rotation is reversed, and by connecting the 40-pole winding of the motor to the six-pole generator the synchronous speed drops to 60 revolutions per minute, or actually to 58 revolutions per minute, giving about three-quarters of the full speed of the ship under this condition. One generator may be stopped and the other left running at full revolutions under governor control, and, therefore, at approximately its full economy, because the power required to drive the ship at three-quarter speed is about half of that required to drive it at full speed. If either of the generators is left attached to its own winding, the other generator being shut down either by intent or by accident, the ship is propelled by either engine at a little over half speed, the speed of the ship falling with the speed of rotation of the engine until an automatic adjustment of power and speed is reached. This occurs at about half speed.

The control gear is so simple as hardly to require any specific description. In the first instance it is not proposed to operate the control from the bridge, but arrangements are made by which this can easily be done, if required. There are five positions on the switch corresponding to the ordinary positions on the engine-room "telegraph." They are "full speed ahead," "half speed ahead," "stop," "half speed astern," and "full speed astern." Each position of the controller is definitely fixed by means of cams and roller, so that stopping at intermediate positions is prevented. For half speed, No. 1 generator is coupled to No. 2 winding of the motor, and No. 2 generator is running light or stopped. For full speed each generator is connected to its own winding on the motor, respectively. The controlling gear provides for the interruption of the excitation of the generators while the switch is being moved from one step to another. This mode of operation renders the electric circuits "dead" while the switching-over operation is being accomplished and thus injurious sparking is avoided.

The inspection of the *Tynemount* took place at the works of Swan Hunter & Wigham Richardson, the builders of the boat, at Wallsend-on-Tyne, England.

Westinghouse Waterwheel Generators.

The successful operation of many high-voltage transmission lines and the ever-increasing demand for power all aid materially in the utilization of many water powers heretofore considered either impracticable or inaccessible. The increased demand for such service requires a wide range of combinations of capacity and speed range in the generating equipment. Refinement in the design of both generators and waterwheels have made these changes possible. Two types of waterwheel generators are built, horizontal and vertical, depending upon the local conditions in each case.



Stator of Waterwheel Generator.

Waterwheel generators of almost any practical capacity or speed for installation in the smallest isolated plant or the largest hydroelectric generating station have been furnished by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Some of the characteristic features of these machines will be described in this article.

The standard horizontal unit is of the two-bearing, coupled-type construction; that is, the generator includes shaft, two bearings, and a bedplate usually designed to allow for sliding the stator to one side

in case ready access to either the stationary or rotating winding is desired.

The stationary frame is made of a strong, rigid iron casting, into which soft-steel laminations are dove-tailed and securely fastened. Ventilating ducts are spaced at frequent intervals across the face of the armature punchings, allowing for perfect ventilation to all parts of the active material. Form-wound interchangeable armature coils fit into parallel open slots punched in these laminations, and these coils are held firmly in place by means of fiber wedges. The coils are insulated and impregnated with fabrics and compounds of high insulating qualities.

No single type of construction will meet the varied requirements in rotor design. Therefore, several well tested methods are employed. When comparatively low peripheral speeds are encountered a cast-iron spider with bolted-on, or dove-tailed poles, is usually employed. For higher speeds cast-steel or steel-plate construction may be used. In the case of very large relatively high-speed machines, the difficulty of securing perfect castings may lead to the well proven laminated-rim structure.

Laminated-Rim Rotor Without Field Poles.

All field poles are made of thin steel laminations riveted together with overhanging pole tips provided to support the field windings. Field coils are wound of heavy copper strap on edge, insulated in such a way that each individual turn is exposed to ventilating air, and thus perfect radiation results. The coil is securely fastened between the rotating spider and the tips of the field poles by heavy coil supports.

All parts are carefully inspected during each step in the process of manufacture, and before the succeeding operation is started. When completed the machine is carefully tested under conditions as nearly identical as possible to those which its future service will demand.

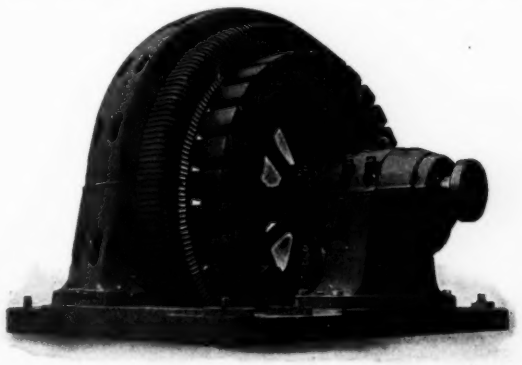
In the case of vertical machines, Westinghouse standard practice recommends that the generator be fitted with two guide bearings which are supported by brackets fastened to the stator frame. There is also provided a bedplate or pad on which the stationary part rests.

The roller or thrust bearing which supports the weight of the revolving part may be mounted on top of the generator frame, between generator and turbine, or underneath the turbine. In case it is mounted on top of the generator frame, this frame must of course be made heavier and more expensive, than in cases where it has only to support the stator punchings, winding and guide bearings. Wherever placed, this bearing usually supports not only the rotor of the generator, but also the turbine runner, and in addition takes care of any unbalanced water thrust.

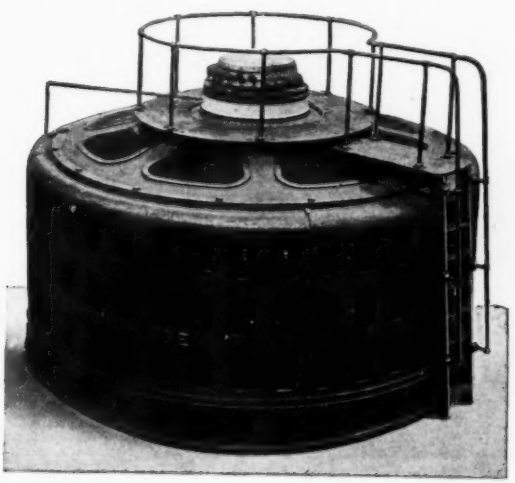
A rigid cast-iron frame, into which soft-steel laminations are securely dovetailed, forms the basis of the stator. Form-wound interchangeable armature coils are held in open slots by means of fiber wedges. The coils are vacuum-dried and impregnated before the outside insulation is applied. This consists of wrappings of paper and mica on the straight portions of the coils which lie in the slots, and servings of treated cloth over the V-shaped coil ends. After the outside insulation is applied the coils are treated with an insulating varnish which renders them moistureproof and oilproof. An insulating cell is provided in each armature slot to prevent abrasion of the coil and a fiber wedge holds coil and cell firmly in position.

In case of failure of a waterwheel governor to act, the rotating part of both waterwheel and generator are subjected to unusual stresses, due to the overspeeding of these parts. The rotors are designed for the maximum obtainable speeds which result in such instances. These overspeeds vary from 50 to 100 per cent. Due to the wide range of speeds encountered, no one type of rotor construction will give ideal results.

Field coils are ordinarily wound with heavy copper strap on edge and insulated between turns with asbestos. This construction is particularly well adapted to give perfect radiating qualities and because of the heavy strap used is practically indestructible. The coils are securely fastened.



Horizontal Generator, Showing Method of Sliding Stator to One Side.



Vertical Generator, 12,500 Kilovolt-Amperes, 6,600 Volts.

Conlon Electric Washing Machine.

The Conlon Electric Washer Company, 312-320 North May Street, Chicago, has recently placed on the market an electric washing and wringing machine which embodies many new and improved features in the way of gear drive and safety attachments. These machines, which are on exhibition at the New York Electrical Show, are made in three sizes, suitable for use in private homes, hospitals, institutions, hotels, etc. They have capacities of six, nine and twelve sheets, respectively, and are equipped with Westinghouse motors which will operate the washer and wringer at the same time.

The design is very compact, and all the gears and moving parts are entirely inclosed. Unlike most electric washers this machine is directly driven from the motor by means of a bronze worm gear, instead of the customary belts and chains. Another new feature is the absence of all gears inside the washer. This eliminates any possibility of the clothes being damaged while in the machine. One of the special features is the patented safety wringer release, a slight touch of which instantly releases the tension on the wringer rolls. This machine has found instant popularity with the trade on account of its excellent construction and improved features.

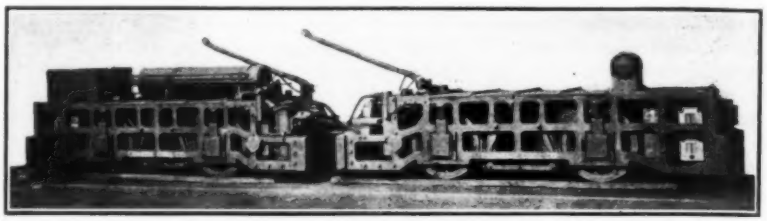
Motor-Driven Washing Machine.

The Conlon Electric Washer Company has many unique selling plans for co-operating with central stations and dealers, which, together with the intrinsic merits of the machine itself, should aid in making easy sales of these machines.

The Largest Mine Locomotives Ever Built.

The Carnegie Coal Company has recently installed at the Charleroi (Pa.) coal works two of the largest nine locomotives ever built. These locomotives weigh thirty tons apiece and are of the Baldwin-Westinghouse Barsteel type. It is estimated that each locomotive can haul 100 cars, each loaded with three tons of coal, over the local grades. The reasons for using such large locomotives are as follows: The Carnegie company recently acquired possession of the Charleroi mine, which is of considerable size and is well developed. A large production is desired from it, but the haul is about two miles long, with the grade largely against the load. Hence the average haulage locomotive of from 15 to 25 tons would not be sufficiently large to keep production up to the estimated tonnage.

The new locomotives possess a number of interesting features. Each locomotive consists of two separate units, which can be separated and used as 15-ton locomotives, if desired. This use of two units in tandem is advantageous in such large machines because the weight is distributed over eight wheels instead of four, and hence the locomotive has great tractive power, and also is easier on the track.



Thirty-Ton Double-Unit Mine Locomotive.

The Barsteel construction represents the most modern type of design. As is clearly seen in the illustrations, the frames are not built up of plates, but are formed of a grid of steel bars of heavy cross-section. The side frame of each unit is cast separately, forming an extremely strong and rigid construction. The openings in the frame give ready access for inspecting, oiling, replacing brake shoes, adjusting brake rigging, etc., and also provide ventilation to the motors.

The controller for the tandem is of the individual magnetic blowout type and handles all four motors at once. When the tandem is split, the four-motor controller handles the two motors of its unit without change in connections, while the other unit has its own two-motor controller.

In addition to the two large haulage units the Carnegie Coal Company has installed at Charleroi ten traction-reel gathering locomotives or "crabs," also of the Baldwin-Westinghouse Barsteel type.

Half of the Tandem Unit Hauling Cars on Tipple.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

POLK, NEB.—The Council will expend $16,000 for a water and light system. Address the city clerk.

FULTON, KY.—The Fulton Electric Light & Power Company is planning to install additional equipment.

ARMA, KANS.—Albert C. Moore, of Joplin, will have charge of constructing a $26,000 light and water system here.

CANTON, O.—The Council plans to establish a municipal lighting plant. Address the city clerk in regard to the matter.

HOMESTEAD, FLA.—The Town Council is planing to build a lighting plant here. Address J. W. Free, president.

EUGENE, ORE.—The City Council has ordered the installation of an electric post-lighting system on Olive Street. O.

MADISON, WIS.—A system of lighting in Capitol Park will be installed this fall. Address Mayor Meinz for information.

DAVENPORT, IOWA—Alderman William Gosch is in favor of a better lighting system for the streets of Davenport.

KENTON, TENN.—$30,000 will be expended to construct an electric light plant here. Address the city clerk for particulars.

MONROVIA, CAL.—The Council is planning to establish an ornamental lighting system. Address the city clerk for particulars.

CAMDEN, S. C.—$35,000 will be expended for a modern electric lighting system. Address the city clerk in regard thereto.

ESBON, KANS.—The Council will install a $33,000 light and water system. Address the city clerk in regard to this project.

WAYNE, PA.—The Wayne Protective Association is planning to extend the lighting system. Address, John S. Freeman for information.

HAMILTON, NEV.—The Hamilton Power Mining & Transportation Company is preparing to erect a hydroelectric plant here to cost about $35,000.

CRESTON, ILL.—The Council is planning ways and means to establish an electric lighting system here. The city clerk is in charge of the matter.

SAN DIEGO, TEX.—The local electric light plant was recently destroyed by fire, the loss being $7,000. Address the city clerk in regard to rebuilding.

MARSHALLVILLE, GA.—The Council is planning to establish a $20,000 light and water system. Address J. O. Bootonm, mayor, for desired information.

STRONG, OKLA.—A charter has been granted to the Grand River Power & Electric Company, capitalized at $5,000. The incorporators are H. C. Holderman, E. L. Stegall and Maude A. Holderman.

MOUND CITY, MO.—The Mound City Electric Light & Ice Company is planning to construct 10 miles of 6,600-volt transmission line and two steel towers.

NEW LONDON, MO.—North Missouri Light & Power Company has been incorporated with a capital stock of $60,000 by S. C. Gill, M. C. Biggs and W. E. Keithley.

THE DALLES, ORE.—The plant of the Oregon Power Company, here, recently sustained a loss from fire estimated at $1,500. The damage will be repaired at once. O.

MOOERS, N. Y.—The Mooers Electric Light Company has been incorporated with a capital stock of $5,000 by H. Wallace Knapp, Minnie L. Knapp and F. E. Filmore, all of Mooers.

BERLIN, WIS.—The Berlin Street Lighting Association has been formed by business men. A fund of $3,000 has been raised for the installation of forty-six ornamental lights. Z.

BATLE CREEK, MICH.—The Urbandale Improvement Association plans to extend electric lighting to the suburb of Urbandale. Address City Attorney Burnett Hamilton for information.

PITTSBURG, TEX.—A move to organize a new electric light and ice plant for Pittsburg has been started here and approximately $15,000 has already been subscribed by the business men.

DAYTON, O.—So rapid has been the increase of the business of the Dayton Power & Light Company since the flood that plans are under way for the erection of a third big power plant.

WHEELER, ORE.—The City Council has granted the Wheeler Lumber Company an electric lighting franchise covering the highways of this place. A distributing system will be put in at once.

KALAMAZOO, MICH.—The residents of South Street have on foot a movement to provide a continuation of the ornamental lighting system on South Street. Address the city clerk for particulars.

LOS ANGELES, CAL.—The Board of Supervisors will on October 20 receive bids for the installation and for the maintenance for five years of a lighting system in the Van Nuys Lighting District in this county.

DIXON, KY.—Melton Brothers are planning the installation of an electric light plant for street lighting purposes. The concern operates a flour mill. It will probably be in the market for second-hand equipment. G.

LOS ANGELES, CAL.—The Board of Supervisors of this county has adopted plans and specifications for the lighting system of the Moneta Lighting District, and has advertised for bids for the installation of the system.

NEW HOPE, N. J.—The New Hope Vitrified Brick Company will operate all the machinery installed in its new brick manufacturing plant to be erected here with electric motors. Brick will be burned by a producer-gas system.

PORT CLINTON, O.—A petition asking the City Council to order a vote on a bond issue for the building of a municipal lighting plant is being circulated here. Address the city clerk in regard thereto.

SPOKANE, WASH.—The City Council recently voted an appropriation of $5,000 for the purpose of securing definite engineering data concerning the establishment of municipal light, heat and power plant. O.

CARLTON, ORE.—The City Council has granted a 25-year electric-lighting franchise in this place to the Yamhill Electric Company. The company will put in a transmission line connecting the city with its plant at Newberg.

HIGHMORE, S. D.—At a meeting of the City Council a committee of three was appointed to make arrangements to have the principal business street of Highmore lighted with cluster lights. Address the city clerk for particulars.

MORRISTOWN, N. J.—The Superintendent of Sewers is planning for the installation of electric pumps in the Wetmore Avenue district, to be used for forcing the sewerage from an ejector chamber to the city disposal works. A.

JEFFERSON CITY, MO.—The installation of a municipal electric lighting plant is under consideration and an expert engineer has been directed to prepare plans and estimates for construction of it. P. C. Harding is city engineer.

ANACONDA, MONT.—The Northern Pacific Railway has been granted a franchise by the Granite County Commissioners for the construction of electric power transmission lines over certain portions of Granite County.

COLORADO, TEX.—The Colorado Electric Light & Power Company has sold its electric light plant and other holdings here to the Texas Power & Light Company, of Dallas, who will improve the plant and extend the lighting system. D.

NEWARK, N. J.—A power plant will be installed in the basement of the main building of the new baking plant to be erected by the Williams Baking Company on South Tenth Street. Electrically driven ventilating fans will be installed in the oven room. A.

TACOMA, WASH.—An ordinance appropriating $12,000 from the light fund for the construction of an auxiliary transmission power line between the city substation and the Nisqually municipal power plant has been passed by the City Council. O.

WARDNER, IDAHO.—Walter C. Clark, superintendent of the Electrical

Department, Bunker Hill & Sullivan Electric Company, is authority for the assertion that a new system of tungsten lighting will be installed in Wardner and Kellogg. O.

SAN FRANCISCO, CAL.—The Universal Gas & Electric Company of this city has applied to the Board of Supervisors for permission to extend its services very materially. Rudolph Spreckels of the company says that large extensions in both electric and gas fields are contemplated.

LIMA, O.—Announcement has been made by the Schoepf syndicate of electric lines of the intention to expend $78,000 in improvements. A sub-powerhouse, for which ground has already been purchased, will be constructed and equipped to feed all lines of the concern, even to Springfield on the south. H.

ASHLAND, ORE.—The Oregon & California Power Company will extend its service lines into the interurban districts, including the small village of Suncrest. Power and light lines will be extended to the ranches lying in this vicinity, and current will be furnished the Suncrest Orchard Packing Company. O.

LOS ANGELES, CAL.—The Supervisors of Los Angeles County are asking for bids for the lighting work that will give the San Fernando Valley a 25-mile circle of paved and lighted boulevard, the longest continuous ornamental lighting system in the world, and destined to become one of the show features of this section. T.

BELLINGHAM, WASH.—The Puget Sound Traction, Light & Power Company has filed papers appropriating water rights in Baker and Skagit Rivers, preliminary to the erection of power plants. The rights were formerly appropriated by the Skagit Power Company which was recently absorbed by the Puget Sound Traction, Light & Power Company.

SPOKANE, WASH.—Morton McCartney, city engineer, recently filed plans with Commissioner of Public Utilities C. E. Fassett, for the construction of a luminous arc curb-lighting system to be established on Riverside Avenue, from Washington to Division Streets. The cost of this improvement it is estimated will be over $27,600. O.

SAN FRANCISCO, CAL.—The towns of Marine View, Moss Beach, Farallon and Montara, along the Ocean Shore railroad south of this city, have formed a lighting district, and a movement is under way to form another lighting district including other districts along the same road. The two districts will cover the country down the shore from San Francisco a distance of 20 miles.

JENKINS, KY.—The Consolidation Coal Company is planning to increase the capacity of its power plant from 6,000 kilowatts to 15,000 kilowatts, in connection with a plan to construct a number of transmission lines to other coal mining centers and to supply current both for light and power to the communities of Eastern Kentucky. Construction of the transmission lines has been begun. The company will connect the plant at Jenkins with one at Van Lear, Ky., which was recently completed. G.

BOISE, IDAHO.—The City Council has taken preliminary steps towards the construction of a municipal waterworks and electric-lighting system. The city engineer has been instructed to secure data on a gravity system from the diversion dam, eight miles from Boise, which will supply almost the entire city, with a high-pressure water system. The mayor has been authorized to take up with the United States government the proposition of acquiring power from the diversion dam, and from Arrow Rock for lighting purposes. O.

CENTER VILLAGE, N. Y.—The Up-State Public Service Commission has received an application from the Afton-Windsor Light, Heat & Power Company of Binghamton, for permission to construct transmission lines and furnish light, heat and power in the village of Alton, Chenango County, and the towns of Windsor and Colesville, Broom County. The plan of the company is to develop a hydroelectric plant in Center Village, near Binghamton, together with a steam plant to be used in times of low water or flood. The company would furnish service 365 days in the year.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company announces the completion of its Lake Spaulding dam on the South Yuba River to the 215-foot level. This is a monolithic concrete dam, which, when completed, will be 305 feet high, and will give Lake Spaulding a storage capacity of 100,000 acre-feet. It is intended that 190,000 horsepower shall be developed. Up to August 31, the total expenditures at Lake Spaulding had reached over $5,000,000. This company will soon begin the erection of a new substation at Avon near Martinez, Cal., which will be equipped to handle 60,000 volts.

SAN FRANCISCO, CAL.—Secretary of Agriculture Houston has signed a permit to the Southern California Edison Company of Los Angeles for extensive progressive development of water power on the Kern River in the Kern National Forest. The development will consist of four power plants of modern construction with conduit lines placed entirely in tunnels. These will be similar to the Kern River No. 1 plant of the same company, which has been in operation for several years at a point lower on the river. Plant No. 5, the highest of the plants, will divert its water at the outlet of Kern Lake, and the power house will be located just below the mouth of Little Kern River. The discharge from this plant will be diverted into the conduit of Plant No. 4. Power House No. 4 will be on the west bank of the river at the mouth of Brush Creek. The intake of Plant No. 3 will be a short distance below the latter point, and Power House No. 3 will be approximately six miles above Kernville. Plant No. 2 will divert its supply a short distance below the Borel plant of the Pacific Light & Power Company in the outskirts of Kernville, and the intake will carry the water down to a power house just above the intake of the present Kern River No. 1 plant of the Southern California Edison Company referred to above. It is given out that even during the lowest water plant No. 5 will develop over 13,000 horsepower. Just below the company's Plant No. 1 is the development of the San Joaquin Light & Power Corporation; and below this is a site for one small additional development. When this is put in, the power of the Kern River will be completely utilized.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

VENICE, CAL.—On October 27 the City Council will offer for sale a 40-year telephone franchise in this city.

SIOUX CITY, IOWA.—The National Board of Underwriters has recommended improvements in the fire-alarm system.

DENTON, MONT.—The Commercial Club is endeavoring to have the Bell Telephone Company build a line to this place. C.

MT. VERNON, TEX.—Yale Telephone Company has been incorporated by J. H. Godwin, Jasper Ferguson, J. G. Carr and others, all of Mt. Vernon.

LEONARD, TEX.—The Leonard Telephone Exchange has been incorporated with a capital stock of $10,000 by J. A. Craft, O. S. Ferguson and others.

ST. LOUIS, MO.—Stoddard County Telephone Company has been incorporated with a capital stock of $1,000 by L. A. Hobbs, William Goddard and W. E. Pope.

SPOONER, WIS.—The Tri-State Telegraph & Telephone Company will erect a line from Minneapolis to Superior and Duluth, passing through this place. C.

STANLEY, WIS.—Otter Creek Telephone Company has been incorporated with a capital stock of $1,000 by John J. Hatfield, James Niven and W. A. Abbott.

FOX SPRING, TENN.—The Fox Spring Home Telephone Company has been incorporated with a capital stock of $1,000 by J. E. Sidwell, J. D. Hunter and others.

HAMPTON, S. C.—The Home Telephone & Telegraph Company has been incorporated with a capital stock of $20,000 by S. A. Agnew, J. Reid Fitts and others.

GREEN BAY, WIS.—The entire exchange of the Wisconsin Telephone Company will be reconstructed and the wires placed underground. The estimated cost is $61,000. C.

FLAGSTAFF, ARIZ.—The Indian Department of the Federal Government has secured an appropriation for a telephone line connecting Tuba with this place. The line will be about 90 miles long.

MOLINE, ILL.—The Automatic Telephone Company has completed plans for the building of a plant for 40,000 telephones in the tri-cities. Almost all the wires will be placed underground.

COLBY, WIS.—The Cark County Telephone Company, Incorporated, has filed articles of incorporation, capitalized at $32,000. The incorporators named are W. J. Rush, H. H. Christofferson and C. H. Brown.

OKLAHOMA CITY, OKLA. — A charter has been issued to the Vinson Telephone Company, of Vinson; capitalized at $7,600. The incorporators are Forest F. Francis, J. M. Burleson and H. T. Baxter.

NEWPORT, KY.—The Citizens' Telephone Company has been ordered to construct an underground-conduit system for its wires, the local court having also entered a fine of $50 a day since the city ordinance requiring this improvement went into effect. G.

SAN FRANCISCO, CAL.—The Reedley Telephone Company, of Reedley, Cal., has applied to the California State Railway Commission for authority to issue 2,500 shares of stock of the par value

of $1 per share, the proceeds to be used in putting in improvements at Reedley.

VANCOUVER, WASH. — H. A. Gasham, a marine surveyor, has been instructed by the Dominion Government to take soundings in Nodalles, Okis, and Cardero Channels, waterways separating Valdez and Thurlo Island, and the mainland, in which something like 115 miles of telephone lines will be laid. O.

FULLERTON, CAL.—The Postal Telegraph Cable Company is contemplating the extending on to San Diego from this city of its new telephone line, the old line which was erected about 20 years ago to be torn down. This company has just completed a telephone line between this city and Los Angeles.

SAN FRANCISCO, CAL.—The Pacific Telephone & Telegraph Company has applied to the California State Railway Commission for permission to issue $3,000,000 in bonds. Approximately half of the proceeds will be used for betterments to the company's system, including additional switchboad, line and conduit facilities in San Francisco, Los Angeles, Oakland, San Diego and elsewhere.

DAYVILLE, ORE.—The John Day Valley Telephone Company was recently organized in this city with a capitalization of $5,000, with the express purpose of buying the Sunset Company's lines which run from Canyon City to Dayville, and will also purchase the Spray Telephone Company's line, which runs from Dayville to Mitchell, and from Mitchell to Waterman. When the complete organization has been made, improvements to a large extent will be added. O.

ELECTRIC RAILWAYS.

(Special Correspondence.)

PITTSBURG, CAL.—The Town Trustees of this place have granted a 50-year electric-railway franchise in this place to the Oakland, Antioch & Eastern Railway Company.

HELENA, ARK.—The Helena Street & Interurban Railway Company is making preliminary surveys for the extension of its lines in Helena. A. P. Horner is general manager.

LOS ANGELES, CAL.—The City Railway Company of this city has taken over the franchise formerly held by Henry M. Dennison for a double-track electric railway on South Main Street.

SAN DIEGO, CAL.—In addition to spending $92,000 in the construction of concrete car barns, the San Diego Electric Company will, it is understood, spend considerable money in electrical apparatus and extensions. T.

JACKSON, TENN. — The Jackson Railway & Light Company is planning to make extensive improvements to its system and to extend its railway to West Jackson. S. S. Bush, Columbia Building, Louisville, Ky., is manager.

LANSING, MICH. — The Tri-State Railway Company, capitalized at $100,000, has been authorized by the State Railroad Commission to incorporate for the purpose of building an electric road from Pioneer, O., to Hillsdale.

SOUTH VANCOUVER, B. C.—The British Columbia Electric Railway Company will extend its line from Woodward's Slough to Fraser Avenue, thereby giving the residents of Lulu Island adequate power service. O.

MIDDLESBORO, KY.—The authorities of this place are preparing to create a franchise, asked for by Dr. W. Godfrey Hunter, providing for the construction of a street railway system. Interurban lines will also be built, it is proposed. G.

THIEF RIVER FALLS, MINN.—The Minnesota Northwestern Electric Railway Company has been incorporated with a capital stock of $500,000. The company proposes to do a general passenger business in the vicinity east of Thief River Falls.

NEWARK, N. J.—The Board of Public Utility Commissioners has approved of an ordinance granting the Public Service Railway Company a franchise for the building and operation of a line on Hawthorne Avenue. The company will immediately commence construction work.

MATTOON, ILL.—The Kankakee Urbana Traction Company now operating an electric railroad between Urbana and Rantoul, has completed arrangements to build an electric line between Urbana, Champaign and Mattoon. Address G. M. Bennett for particulars.

PIERRE, S. D.—The Niobrara Water Power Railroad Company has been chartered to build an electric railroad into South Dakota, beginning at Yankton with a bridge across the Missouri and connecting with the bridge at Sioux City. The incorporators are C. W. Baker, of Omaha; M. P. Buyman, of Leigh, Neb., and others.

SAN FRANCISCO, CAL.—The San Rafael & San Anselmo Railway Company has applied to the California State Railway Commission for authority to issue 4,000 shares of stock of the par value of $25, and $100,000 in bonds, the proceeds of which are to be used in the construction of a storage-battery electric railway between San Rafael and San Anselmo, Cal. The company will take over franchises held by S. J. Norton.

IDAHO FALLS, IDAHO.—The City Council recently granted the Idaho Falls Electric Railroad Company a franchise to build and operate an interurban railway through the streets of the city, and into the adjacent country. About 40 miles of line will be built. Construction work is to begin within three months and the road completed and in operation within two years. Local stock to the amount of $1,000 to the mile is being subscribed. The franchise covers a period of 50 years. O.

OKLAHOMA CITY, OKLA.—Articles of incorporation have been granted to the North Canadian Valley Railroad Company, with principal offices in this city. J. Kenneth Wright, W. A. Lybrand, F. B. Owen, Norman H. Wright and Henry G. Snyder are the incorporators, all of Oklahoma City, and the capital stock of the road is $100,000. It is proposed to build an electric line from Oklahoma City to Shawnee, costing approximately $3,000,000. The line will leave Oklahoma City from the north or east, and will be 40 miles in length.

RICHMOND, VA.—Citizens of Henrico County living between the corporate limits of the city and Fort Lee are perfecting plans for an electric railway shortly to be built from Richmond to Fort Lee. A survey of the proposed line has been made, practically all the rights of way have been obtained and about $15,000 has been promised toward stock subscriptions. Those interested in the proposed road are, among others, K. T. Crawley, W. J. Parrish, Allen G. Collins, Arthur C. Nelsen, Henry Rich, W. L. Brittle, C. E. Jones, T. H. Farrand, L. H. Kemp, George Preston and W. E. Bunn. The line will be about four and one-half miles long and will develop one of the most prosperous sections in this county. It will serve a territory in which over 5,000 people are now living, and in which the population is rapidly increasing.

PROPOSALS.

DIRECT-CURRENT ELECTRIC MOTORS.—Sealed proposals will be received until October 22 for furnishing and delivering nine direct-current electric motors at the Water Works Shops at 2304 South Ashland Avenue. The motors are to vary in size from two horsepower to 15 horsepower. Address L. E. McGann, Commissioner of Public Works, Chicago, Ill.

GENERATOR SET.—Sealed proposals indorsed "Proposals for Motor Generator Set" will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until November 8 for one 100-kilowatt motor-generator set and switchboard accessories at the Naval Station, Pearl Harbor, Hawaii. Specifications may be obtained upon application to the Bureau.

ELECTRICAL EQUIPMENT.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until October 21 for furnishing and erecting two 10-ton three-motor electric traveling cranes, as per Schedule 5,892, to be delivered at the Navy Yard, Philadelphia, Pa.; for 10 radio receiving sets, as per Schedule 5,890; to be delivered at the Navy Yard, Brooklyn, N. Y.; and for one five-kilowatt 125-volt turbogenerating set for 140 pounds steam pressure, as per Schedule 5,893, to be delivered at the Navy Yard, Puget Sound, Wash.

LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until November 10 for furnishing the lighting fixtures for a two-story building for the post office at Blue Island, Ill.; until November 12 for furnishing the same for a two-story building for the post office at Concordia, Kans., and until November 14 for furnishing the same for a two-story building for the post office at Delevan, Wis. Drawings and specifications may be obtained either from the custodians of the sites or the office of the Supervising Architect.

LIGHTING, POWER AND EXPERIMENTAL PLANT.—Sealed proposals will be received by the Board of Trustees of the Ohio University, Athens, O., until November 5 for furnishing all the materials and labor necessary to construct and erect a plant for the University to be used for lighting, power and experimental purposes, according to plans and specifications which are on file at the office of the secretary of the Board of Trustees, I. M. Foster, Athens; at the office of the engineers, A. A. Atkinson and George McLaughlin, Athens; and at the office of the Auditor of State and of H. H. Harnig, treasurer. A bond in the amount of 50 per cent of the amount of the proposal must accompany bids.

FINANCIAL NOTES.

The stockholders of the United Electric Light Company, Boston, have voted to increase the capital stock of the company from $1,500,000 to $1,750,000 in order to provide funds for needed extensions of the plant.

The Mount Whitney Power & Electric Company has sold $150,000 first-mortgage six-per-cent bonds, which were approved by the California Railroad Commission. The bonds are part of an authorized issue of $5,000,000, of which $1,975,000 are now outstanding.

The Consumers' Power Company, of Minnesota, has sold $100,000 first-mortgage five-per-cent bonds. The proceeds will be used for improvements and extensions of the company's subsidiaries. All the stock of this company is owned by the Northern States Power Company.

An issue of $10,000,000 six-months' notes, representing financing of several subsidiaries of the American Telephone & Telegraph Company, has been sold through J. P. Morgan & Company and Kidder, Peabody & Company on a 5.5-per-cent basis. The notes were indorsed by the parent company.

At a special meeting of stockholders of Galveston-Houston Electric Company at Portland, Me., the authorized capital stock was increased to $9,000,000 by the addition of $1,000,000 each of common and preferred. There was formerly outstanding $3,000,000 preferred and $4,000,000 common.

At the special meeting of the stockholders of the Electric Company of America about 4,000 shares out of the remaining 5,900 shares, still outstanding, were represented. The vote on the question of final dissolution was about evenly divided, but a two-thirds vote would be required to terminate the company's existence, the resolution looking to this end, adopted about six weeks ago by the directors, was defeated. It is probable that the directors will attempt again to bring the matter up. It is desired to bring about the dissolution of the company in order to terminate what the directors regard as the useless expense of maintaining an organization. The company's sole business now is the collection of the interest on the American Gas & Electric five-per-cent bonds and distributing it in the form of dividends on the 5,900 shares of stock which have not yet been exchanged for the bonds in accordance with the sale agreement. The original stock was 448,662 shares, par value $10. The exchange was at the rate of $14 in bonds for each $10 par of stock.

Dividends.

American Light & Traction Company; quarterly of 1.5 per cent on preferred and 2.5 per cent in cash and 2.5 per cent in stock on common, payable October 30 to stock of record October 14.

Brooklyn City Railroad; quarterly of two per cent, payable October 15 to stock of record October 7.

Commonwealth Edison Company; quarterly of $2, payable November 1 to stock of record October 18.

Fort Worth Power & Light Company; regular quarterly of 1.75 per cent on the preferred, payable November 1.

Havana Electric Railway, Light & Power Company; regular semi-annual of $3 a share on the preferred and $2.50 on the common, payable November 15.

Houghton County Electric Light Company; semi-annual of 75 cents, payable on preferred November 1 to stock of record October 15, and 62.5 cents, semi-annual, on the common, payable the same date.

Jacksonville Traction Company; quarterly of $1.50 on preferred, payable November 1 to stock of record October 15, and $1.75 on common, payable the same date.

Mexican Light & Power Company; semi-annual of 3.12 per cent on preferred and quarterly of one per cent on ordinary shares, payable October 15 to stock of record October 6. The former is payable November 1 to stock of record October 12.

Milwaukee Electric Railway & Light Company; quarterly of 1.5 per cent on preferred, payable October 31 to stock of record October 20.

Public Service Investment Company; regular quarterly of $1.50 on preferred, payable November 1 to stock of record October 15.

Puget Sound Traction & Power Company; regular quarterly of $1.50 on preferred and $1 on common, both payable October 15 to stock of record October 7.

Sierra Pacific Electric Company; quarterly of $1.50 on the preferred, payable November 1 to stock of record October 15.

Reports of Earnings.

WESTERN POWER COMPANY.

	1913	1912
August gross	$ 229,510	$ 196,061
Net after taxes	138,430	74,544
Surplus after charges	56,933	*11,010
Eight months gross	1,769,963	1,461,543
Net after taxes	1,175,644	823,917
Total income	1,311,205	829,850
Surplus after charges	542,392	160,976

*Deficit.

BAY STATE STREET RAILWAY.

The income account of the Bay State Street Railway fiscal year ended June 30, 1913, as filed with Massachusetts Public Service Commission, compares as follows:

	1913	1912
Operating revenue	$9,206,403	$8,877,943
Operating expense	6,047,906	5,750,051
Total net	3,352,740	3,309,792
Surplus after charges	184,076	391,782

AMERICAN TELEPHONE & TELEGRAPH.

The report of the American Telephone & Telegraph Company to the Massachusetts Public Service Commission, for the year ended June 30, 1913, compares as follows:

	1913	1912
Gross	$20,116,907	$18,534,249
Operating expenses	10,005,075	8,864,404
Net	10,111,832	9,669,845
Other income	31,182,189	26,462,222
Total income	41,294,021	36,132,067
Charges	8,082,424	6,621,100
Surplus	*33,211,597	29,510,967
Dividends	27,050,934	24,035,613
Total surplus	6,160,663	5,475,354

*Equal to 9.63 per cent on $344,552,400 capital stock outstanding, as against 8.88 per cent on $332,144,304 stock previous year.

FEDERAL LIGHT & TRACTION.

	1913	1912
August gross	$ 181,273	$ 175,008
Net	77,709	68,982
Eight months gross	1,546,889	1,383,236
Net	656,916	570,983

EL PASO ELECTRIC.

	1913	1912
August gross	$ 65,590	$ 63,401
Net after taxes	28,511	28,086
Surplus after charges	25,949	22,727
12 months gross	867,856	750,768
Net after taxes	400,363	335,111
Surplus after charges	360,867	255,242

GALVESTON-HOUSTON ELECTRIC COMPANY.

	1913	1912
August gross	$ 23,139	$ 199,208
Net after taxes	105,125	95,287
Surplus after charges	70,481	61,621
12 months gross	2,289,112	1,835,279
Net after taxes	980,474	735,995
Surplus after charges	567,942	388,484

WEST PENN. TRACTION & WATER POWER.

The West Penn. Traction & Water Power Company reports for the year ended Aug. 31, 1913, compared as follows:

	1913	1912
Gross	$4,471,072	$2,828,355
Net after taxes	1,955,919	1,344,058
Surplus after charges	832,266	693,501
Dividends	235,000	235,000
Surplus	597,266	458,501

COMMONWEALTH POWER.

In its report for August and the twelve months ended August 31, 1913, the Commonwealth Power, Railway & Light Company shows earnings accrued to it from stocks of subsidiary companies and other earnings as follows:

	1913	1912
August gross	$ 165,043	$ 66,367
Other income	36,177	25,382
Total gross	201,221	91,749
Net after taxes and int.	143,958	57,810
Bal. after pref. divs.	63,958	7,810
Twelve months gross	1,664,578	525,671
Other income	205 517	114,599
Total gross	1,870,095	640,270
Net after taxes and int.	1,572,158	466,389
Bal. after pref. divs.	1,012,158	246,389

UNITED RAILWAYS.

The United Light & Railways Company reports consolidated earnings of subsidiary companies for August, 1913, and the twelve months ended August 31, 1913, as follows:

	1913	Increase
August gross	$ 518,998	$ 67,582
Net after taxes	213,898	19,541
Surplus after charges	112,168	7,542
Twelve months gross	5,833,680	703,030
Net after taxes	2,398,108	316,048
Surplus after charges	1,221,375	248,014

Earnings accruing to securities of the United Light & Railways Company from the surplus of subsidiary companies, including other earnings for August and the twelve months ending August 31, 1913, were:

	August	12 Months
Gross earnings	$132,982	$1,123,259
Net after exp. and int.	95,824	932,909
Dividends first preferred	37,098	386,952
Dividends second pref'd	7,340	89,310
Bal after pref'd divid's	51,386	456,646

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Oct. 13	Oct. 6
American Tel. & Tel. (New York)	120⅞	126¼
Commonwealth Edison (Chicago)	152	153
Edison Electric Illuminating (Boston)	267	268
Electric Storage Battery common (Philadelphia)	47½	47¾
Electric Storage Battery preferred (Philadelphia)	47½	47¾
General Electric (New York)	140¼	144½
Kings County Electric (New York)	119	119
Manhattan Transit (New York)	1¼	1¼
Massachusetts Electric common (Boston)	15	15
Massachusetts Electric preferred stamped (Boston)	67½	67¾
National Carbon common (Chicago)	116	116
National Carbon preferred (Chicago)	115	115
New England Telephone (Boston)	148	148
Philadelphia Electric (Philadelphia)	23	23
Postal Telegraph and Cables common (New York)	80	80½
Postal Telegraph and Cables preferred (New York)	66	67
Western Union (New York)	63	63
Westinghouse common (New York)	68	68⅛
Westinghouse preferred (New York)	110	110

PERSONAL MENTION.

MR. E. E. HUDSON has been elected fourth vice-president of Thomas A. Edison, Incorporated. Mr. Hudson will continue as heretofore in charge of the sales of the primary battery department, with headquarters at Orange, N. J.

MR. J. J. CRAMER, who for many years has been manager of the City Heating & Lighting Company, Fostoria, O., has tendered his resignation and will be succeeded by MR. E. D. CHAPMAN, who has been for some time with the company at Tiffin.

MR. F. N. JEWETT, sales manager of the Wagner Electric Manufacturing Company, St. Louis, Mo., is back at his desk again fully recovered in health. Mr. Jewett has not been feeling well for some time, and has been resting and recuperating practically all during the summer.

MR. JOSEPH HARRINGTON has opened offices at 924 Consumers Building, Chicago, Ill., as advisory engineer in matters relating to the combustion of coal and the organization and equipment of the boiler room, with special reference to the efficiency of the apparatus and the economical production of steam.

MR. EDWARD S. MANSFIELD, who for several years has been in charge of work for the advancement of electric-vehicle interests for the Edison Electric Illuminating Company of Boston, has become comptroller of the operating bureau of that company. MR. CHARLES H. MILES succeeds Mr. Mansfield in the electric-vehicle work.

MR. THOMAS AITKEN has been elected a director of the Consolidated Gas, Electric Light & Power Company, of Baltimore, to fill the vacancy occasioned by the resignation of Mr. George Cator, of Baltimore. Mr. Aitken is manager of the Bank of Scotland in London, and has been instrumental in placing a large amount of the securities of the power company abroad. His election as a member of the Board of Directors will further strengthen the financial connections of the power company in Europe.

MR. WILLIAM M. LEWIS, who recently resigned as manager of the Rockville, Willimantic and Stafford electric light and gas plants in Connecticut, to go to Muskegon, Mich., to accept the management of the Grand Rapids-Muskegon Power Company, was tendered a farewell dinner at the Rockville House, Rockville, Conn., on the evening of Saturday, October 4. In addition to several other gifts from his friends and neighbors, Mr. Lewis received a gold watch from the employees of the three plants.

MR. H. J. PETTENGILL, JR., has been promoted from the post of commercial agent of the Paducah, Ky., Light & Power Company to manager of the commercial department of the Woonsocket, R. I., electric light plant, which is a Stone & Webster property, as is that in Paducah. He has been in the latter city for the past four years. The change is effective October 20. MR. JOHN J. KATES, former commercial agent of the Key West, Fla., Electric Company, will succeed Mr. Pettengill in Paducah.

MR. MARSHALL L. BARNES, who is well known to the electrical fraternity as one of the leading electrical contractors of Troy, N. Y., and also as past president of the National Electrical Contractors' Association, is the Republican candidate for mayor of the city of Troy. Despite his manifold interests, Mr. Barnes has continued to take a keen interest in public affairs in his city. He has been a leader in the promotion of many movements for bettering civic conditions and has definite plans for carrying out several of these projects. Mr. Barnes was one of the leaders in the strong movement for co-operation and harmony that has been manifested in various lines of the electrical industry for the last few years. He was one of the organizers of the electrical contractors' associations in New York State and also of the National Association. The firm of Barnes & Payton, of which he is the senior member, has been in existence nearly 20 years and has executed some of the most important contracting undertakings in Troy and nearby sections of New York and adjoining states.

OBITUARY.

MR. M. JUDSON FRANCISCO, a former president of the National Electric Light Association, died at his home in Rutland, Vt., October 6, at the age of 77 years. He was a native of West Haven, Vt., but at the age of 16 he went to Ohio, and received his college training at Oberlin. In 1861 he became president of the Northwestern Commercial College, Fort Wayne, Ind. Mr. Francisco became Vermont manager for an insurance company in 1870, and carried on that business up to the time of his death. His connection with electric lighting interests began in 1888 when he was made president and general manager of the Rutland Electric Light Company. He continued in this position until 1900. He was a member of the Executive Committee of the National Electric Light Association in 1890 and became president of the Association, at Washington, in 1894. He was for a time secretary and managing director of the Rutland City Electric Company. He was author of a review of the Postmaster-General's Limited Post and Telegraph Bill, which was delivered before the committees of Congress in 1891. He was also the author of Municipal Lighting; Government Ownership; Review of Municipal Monopolies; Municipal Ownership—Its Fallacy; Municipal Ownership vs. Private Corporations; Business of Municipalities and Private Corporations Compared. In connection with measures involvoing questions of public ownership of utilities he appeared as expert before the legislatures of Massachusetts and Connecticut. He was a member of the American Institute fo Electric Engineers, and a Mason. The widow and one son survive.

MR. ADOLPHUS BUSCH, the well-known St. Louis financier and manufacturer, died at Langenschwalbach, Germany, October 10, 1913. Mr. Busch was probably best known through his connection with the brewery interests of this country, although his financial interests were widely scattered and he owned realty in many states. He was the largest stockholder in the Anheuser-Busch Brewing Association. He was also a director in several banks in St. Louis, and a number of public utility corporations. He was interested in breweries in San Antonio, Galveston and Fort Worth, Tex., and owned ice manufacturing plants in various parts of the country. At the time of the St. Louis World's Fair, Mr. Busch was head of the Foreign Department. He was also a guiding principal and financed the development of the Diesel engine in this country, organizing the Busch-Sulzer Diesel Engine Company, of St. Louis. Mr. Busch was a philanthropist of a very practical nature, and his charities are very numerous. One of his recent philanthropies was the gift of $150,000 to Harvard University for the establishment of a Germanic Institution. Every year he gave $5,000 to the convent of the Good Shepherd, in St. Louis. His most recent St. Louis benefaction was a gift of $25,000 for the erection of a memorial to Carl Schurz, Emil Preetorius and Carl Daenzer, the trio of German editors who flourished in St. Louis at about the time of the Civil War. At the time of the San Francisco earthquake and fire, Mr. Busch contributed $100,000 to the relief fund. He also contributed heavily to the relief of the Galveston flood sufferers, and $25,000 to the relief of the Ohio Valley flood sufferers last spring. Mr. Busch, who was 76 years old, was the last of 21 children. He is survived by his widow, five daughters, Mrs. Jacob M. Loeb, of Chicago; Mrs. Hugo Reisinger, of New York; Mrs. Paul von Bontard, of Germany; Mrs. Edward A. Faust, of St. Louis, and Mrs. Edward Scharrer, of Stuttgart, Germany, and his two sons, August A., and Carl, both of St. Louis. Mr. Busch's body was placed on board the *Kroonland* at Bremen, on Tuesday, October 14, and the interment will be at St. Louis.

NEW INCORPORATIONS.

CAMDEN, N. J.—The Eveland Electric Riveter Company has been incorporated with a capital of $10,000. The incorporators are S. S. Eveland, E. A. Reeve and John MacPeak.

NEW YORK, N. Y.—Automatic Electric Sign Company, Incorporated, has filed articles of incorporation with a capital stock of $10,000. The incorporators are Walter E. Godfrey, Emanuel Friedman and Harry O. Liberman, all of New York City.

COSHOCTON, O.—The Ohio Service Company has been incorporated, capitalized at $30,000, for the purpose of generating and dealing in electricity. The incorporators are Frank E. Pomerene, Robert G. Thompson, K. K. Garret, H. S. Lybarger and L. A. Smith.

LOUISVILLE, KY.—Articles of incorporation have been filed by the Reuff-Griffith Decorating Company, capatilized at $5,000. The incorporators are William J. Reuff, Joseph G. Reuff and Minnie M. Griffin. This concern will engage in the electrical decorating business.

DATES AHEAD.

Electrical Exposition and Motor Show of 1913. New Grand Central Palace, New York, N. Y. October 15-25.

American Mining Congress. First national mining show, Horticultural Hall, Philadelphia, Pa., October 17-25.

Association of Railway Electrical Engineers Annual convention, Hotel La Salle, Chicago, Ill., October 20-24.

Electric Vehicle Association of America. Annual convention, Hotel La Salle, Chicago, Ill., October 27-28.

Ohio Society of Mechanical, Electrical and Steam Engineers. Annual meeting, Columbus, O., November 20-22.

American Automobile Association. Richmond, Va., December 1-3.

American Institute of Chemical Engineers, New York, N. Y. December 10-13.

American Association for the Advancement of Science. National annual meeting, Atlanta, Ga., December 29-January 3, 1914.

With the Electrical Manufacturers

New Process Specialty Company, Incorporated, Milwaukee, Wis., announces the removal of its offices from 709 M. & M. Bank Building to 602 Enterprise Building.

The Pittsburgh Lamp, Brass & Glass Company, Pittsburgh, Pa., has published a very interesting bulletin describing its Translux glassware for industrial and artistic illumination of every description.

The Wagner Electric Manufacturing Company, St. Louis, Mo., in bulletin No. 103 illustrates and describes the Wagner single-phase converter. This bulletin is full of very interesting information, and should be in the hands of everyone interested in this subject.

Fort Wayne Electric Works of General Electric Company, Fort Wayne, has published booklet No. 5027 dealing with the Compensarc and other electric current-saving devices for moving-picture theaters. This covers 48 pages well illustrated and dealing with the various forms of Compensarc, the Transpotarc, lighting transformers, etc.

The Calculagraph Company, 1469 Jewelers Building, New York, N. Y., has published a new pamphlet showing how it is impossible for the Calculagraph to make clerical errors. All that is necessary is for the operator to work the handles. The machine does the computation and actually prints the results for quick examination. This pamphlet will be sent to those interested upon request.

The Hart Manufacturing Company, Hartford, Conn., reports the most prosperous year in its history. All departments are running to full capacity and the outlook is for a continuation of maximum demands. The company has recently equipped a number of the largest modern buildings with "Diamond H" switches. Among these are the Architects Building and the Biltmore Hotel at New York.

American Carbon & Battery Company, East St. Louis, Ill., has published catalog No. 100 dealing with flashlight batteries, cases and lamps. These flashlights are made in various forms, all compact and convenient for service. They are equipped with Mazda lamps and with American dry cells, both of these features insuring high efficiency and long life. Copies of this catalog will be sent upon application to the company.

Fairbanks, Morse & Company have moved the headquarters of their southern department from the Chicago office to Atlanta, Ga. This change, it is believed, will greatly facilitate the handling of the company's large southern business. District sales offices will be maintained at New Orleans, La., Jacksonville, Fla., Atlanta, Ga., and Richmond, Va. At each of these points a large stock of engines, electrical machinery, pumps, etc., will be carried for prompt shipment.

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., maker of electric controllers, has recently opened a new district office in Cincinnati, O., located in the Fourth National Bank Building. The general increase in business has made it necessary to establish a permanent office in Cincinnati. Horace L. Dawson, formerly of the engineering department of the company and recently one of the sales engineers connected with the Chicago office, will be in charge of the Cincinnati office.

Hughes Electric Heating Company, 211-233 West Schiller Street, Chicago, Ill., is sending out to those interested a large folder calling attention to several types of its electric ranges, electric radiators and electric bake ovens. The illustrations on the folder show three large installations of Hughes hot plates and other heating devices in the domestic science departments of a number of schools. The folder also calls attention to the campaign of the "Point Five Association" in England for the development of electric heating and cooking and shows that similar efforts applied in this country should prove of great benefit to the central-station industry.

Ercole Marelli & Company, Limited, Milan, Italy, announce the opening of an office at New York City, which will be ready for visitors at the time of the Electrical Exposition at New York. The company will display a full line of its fans, motors and electrical pumps. The company's factory at Milan manufactures a complete line of standard electrical material and keeps a stock of 40,000 fans ready for delivery. The company announces a patented oscillating fan which is a novelty in this country. It also makes a specialty of an electric pump in a compact and reliable form, which is particularly recommended for house pumping and irrigation in agricultural communities. E. Frenkel is in charge of the New York office at 141 West Eighty-fourth Street.

The United States Light & Heating Company, New York and Niagara Falls, N. Y., announces that pressure of business requiring the immediate attention in England and on the Continent of its president, J. Allen Smith, has caused him to start on his second trans-Atlantic trip of this year on October 11. Mr. Smith will not only attend to unfinished business and new business, but will endeavor to visit the various automobile shows which are held earlier in England and Europe than in this country. As the result of Mr. Smith's first trip abroad this year, the officials of the more prominent automobile and railroad companies abroad are now familiar with the U-S-L trademark and the U-S-L products, particularly the electric starter and lighter, the extensive line of storage batteries, and the company's electric car-lighting equipment. Mr. Smith has announced no definite date for his return to this country.

The Century Electric Company, St. Louis, Mo., is working its entire organization to full capacity to meet the demands for apparatus. R. J. Russell, secretary of the company, returned recently from a two months' trip abroad, and reports that the company's foreign business is in particularly good shape. This company has adopted a most progressive policy with regard to building up its business in this country, and it is enjoying a remarkable demand for repeat orders from electrical contractors, engineers and managers of central stations who have come to realize the thorough reliability of this product. A good many years ago the company adopted a far-sighted policy in placing itself in the attitude of mind of its foreign customers, and today its business outside of the United States is one of very large proportions. The new factory and office building at St. Louis is rapidly nearing completion. Power will be secured from the Keokuk plant of the Mississippi River Power Company, and the plant will be equipped with the most modern and varied installation of manufacturing and testing machinery available.

General Electric Company, Schenectady, N. Y., has recently issued bulletin No. A4142, which deals minutely with the various operating conditions which affect the efficiency and life of incandescent lamps. The subject is treated exhaustively and is prefixed by an explanation of definitions, so that the context may be entirely clear. The advantages to the central station of maintaining high efficiency in the operation of incandescent lamps are analyzed, and curves showing the effects of variations in candlepower, wattage and voltage are included. The advantages of high efficiency to the customer are treated in a similar manner, and the effect of auxiliary apparatus on the lighting system is shown diagramatically and by analysis. The bulletin is well illustrated and should be of considerable value to the illuminating engineer, central station, sales agent, and the customer. Bulletin No. A4137 also recently issued by the company illustrates and describes Curtis steam turbines of 100 to 2,500 kilowatts capacity for driving 60-cycle generators at 3,600 revolutions per minute. These generating sets are of the horizontal-shaft rigid-frame type, and either two or four impulse wheels are used, depending upon the capacity of the generator. These sets include all the latest developments in the Curtis turbine and represent the most advanced stage in turbogenerator construction. The bulletin is profusely illustrated, showing details of turbine construction, path of steam flow, and a number of typical installations.

Gray & Davis, Boston, Mass., manufacturers of the Gray & Davis electric starting-lighting system for automobiles, about a week ago opened their new factory, which is claimed to be the largest plant in the world devoted to the production of automobile starting-lighting systems. The building, which is situated on the banks of the Charles River, covers an area of 380 by 60 feet, and is five stories high, containing a total floor space of 140,000 square feet. Seventeen years ago the company started the manufacture of automobile lamps in Amesbury, Mass., and in 1908 produced its first electirc lighting dynamo. The system is built to crank on the largest as well as the smallest engines thousands of times in succession, and will crank fast enough to fire on magneto. It will do its work in zero weather, when starting conditions are most severe. It is claimed that cars are being operated with this system, which have run 30,000 miles without trouble with either the starting motor or the lighting dynamo. The company maintains 62 service stations throughout the country for the benefit of the many users of its equipment.

Record of Electrical Patents.

Issued by the United States Patent Office, October 7, 1913.

1,074,599. Electric System for Operating Speed-Varying Power Transmission. R. W. Bradley, Fort Collins, Colo. A regulating motor is controlled by series of circuit-closers and circuit-breakers that are actuated by a centrifugal device.

1,074,602. Overload Device. H. R. Canfield, assignor to Electric Controller & Mfg. Co., Cleveland, O. An adjustable circuit-breaker.

1,074,638. Brick Machine. J. W. Moltz, Watsontown, Pa. A barrel and die through which the clay is passed are provided with terminals of an electric circuit.

1,074,648. Telephone-Receiver Stand. M. Schwartzberg, Chicago, Ill. A stand and pair of spring-pressed clamping jaws for holding a receiver to the user's ear.

1,074,654. Thermostatic Heat or Fire Alarm. G. S. Simpson, Morgantown, W. Va. A special push-button arrangement for an electric-alarm circuit.

1,074,672. Metalloidal Material. E. Weintraub, assignor to General Electrict Co. Has high resistance when cold and is conductive when heated; the material is a boron compound produced from boric chloride and hydrogen at high electrically produced temperatures.

1,074,677. Enumeration of Telephone Calls. S. D. Williams, Newport, Wales. Provides for each subscriber two electromagnetically operated meters for registering the number of telephone calls, one meter being at the subscriber's instrument and the other at the exchange.

1,074,695. Motor Attachment. G. K. Clark, Canon City, Colo. A motor-driven machine for winding and cleaning moving-picture films.

1,074,712. Lamp. C. E. Godley, assignor to Edmunds & Jones Co., Detroit, Mich. An electric automobile headlight.

1,074,713. Mail Box. U. C. Greggs and H. Falls, Terre Haute, Ind. Includes a dry cell and a two-point switch adapted to close the alarm circuit on opening and closing of the lid.

1,074,716. Lighting Apparatus. E. A. Hawthorne, Bridgeport, Conn. An electric headlight for vehicles comprises a casing containing a dry cell, a socket, a reflector, lens and lamp.

1,074,724. System of Ignition for Explosive Engines. L. J. Le Pontois, New Rochelle, N. Y., assignor to H. W. Johns. Includes a source of direct current and an inductor magneto alternator.

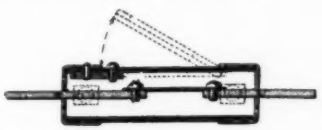
1,074,770. Electric Rat-Trap. C. W. Beardsley, Tacoma, Wash. A bridge piece, an inclined chute and receptacle are each provided with electrode plates of opposite polarity.

1,074,773. Electric Regulator. W. H. Clarke and O. A. Ross, assignors to General Electric Co. A sectional solenoid whose core carries sliding contacts moving over section terminals and resistance terminals.

1,074,777. Distributer for Electrical Ignition Systems. A. Diemer, assignor to Firm of Robert Bosch, Stuttgart, Germany. Has two independent sources of ignition current connected to it.

1,074,790. Engine-Starting Apparatus. E. A. Halbleib, assignor to Northeast Electric Co., Rochester, N. Y. A machine normally driven as a generator operates as a storage-battery-supplied motor to start the engine.

1,074,792. Steam-Superheater. C. S. Hooper and R. C. Stevens, Erie, Pa. An electric mechanism adapted to be controlled by the thermal condition of the steam governs a valve.



1,074,806.—Refillable Fuse.

1,074,806. Inclosed Electric Fuse. W. J. Morgan, assignor to A. L. Eustice, Chicago, Ill. A tubular casing has an elongated opening and closure piece to give access to the interior. (See cut.)

1,074,807. Electrical Suspension-Railway. H. Muller, Leipzig-Gohlis, Germany. Comprises a main supply wire, a trolley wire divided into sections, and a pair of auxiliary train supply wires divided into similar sections.

1,074,813. Time-Controlled Circuit-Closing Device. C. A. Palmgren, Chicago, Ill. Includes a time ring with rows of adjustable contact plugs.

1,074,831. Telegraph Key. R. L. Boulter, Los Angeles, Cal. A contact is pivoted to the key and also has an adjustable connection therewith.

1,074,841. Electric Locomotive. J. L. C. Davis, assignor to Westinghouse Electric & Mfg. Co. Has a pair of driving motors for each axle, the motors having frames which together constitute the entire lower framework of the locomotive.

1,074,859. Electric Signal for Railways. J. H. Gunn, Cortland, N. Y. Is controlled by operation of a track switch.

1,074,860. Electric Reversing Switch and Circuit Closer. C. Haas, assignor to Herrenschmidt & Co., Strasburg, Germany. The flywheel actuates a reversing switch through a special lever with segmental gear and a pinion.

1,074,874. Control System for Electric Motors. J. H. Klinck, assignor to Westinghouse Electric & Mfg. Co. A low-speed and a high-speed motor are successively connected to the machine and automatically accelerated.

1,074,878. Electric Current Controller. H. W. Leonard, Bronxville, N. Y. Provides for automatic control of a motor during acceleration and retardation.

1,074,900. Means for Operating Punch-Gags. W. T. Sears, Hartford, Conn., assignor of one-half to J. V. W. Reynders. Includes two motors, one manually controlled through a solenoid for moving the gag into operative position, and a second motor automatically controlled for moving the gag into inoperative position.

1,074,911. Circuit-Changer. E. Unverricht, assignor to P. de Chapeaurouge, Hamburg, Germany. Includes a pair of circuit-changers, each oscillated by an electromagnet and provided with tilting mercury tubes.

1,074,925. Controller for Electric Motors. R. F. Baerlocher, assignor to Westinghouse Electric & Mfg. Co. A drum shaft is provided with a spring-return mechanism.

1,074,928. Electric Heating Element. T. M. Caven, assignor to A. J. Lindemann & Hoverson Co., Milwaukee, Wis. The resistance element is imbedded within an insulating compound in a recess of a refactory plate.

1,074,943. Automatic Clutch Running Kinematographs and Phonographs Synchronously. L. Gaumont, assignor to Societe des Etablissements Gaumont, Paris, France. An electromagnet releases the clutch at the proper moment.

1,074,949. Electric Lamp. A. G. Hoban and R. L. Marquis, Dayton, O. A sign lamp with conical reflector, at the outer end of which is a removable colored glass screen. (See cut.)

1,074,961. Motor-Controlling Means. H. W. Leonard, Bronxville, N. Y. Electromagnetic switches control each of the resistances in the separately excited field circuit.

1,074,962. Automatic Circuit-Controlling System for Electric Elevators and the Like. N. O. Lindstrom, assignor to A. B. See, New York, N. Y. Provides for dynamic braking.

1,074,984. Spark Timer. H. M. Scheibe, assignor to Westinghouse Electric & Mfg. Co. A circuit-making and breaking switch actuated by a cam.

1,074,988. Apparatus for Electroly-

sis of Fused Alkali Chlorids. E. Steinbuch, assignor to Society of Chemical Industry in Basle, Basel, Switzerland. Provides separate chambers for the anode and cathode and means to prevent the products of the electrolysis from recombining and from acting on any part of the cell.

1,074,999. Method and Apparatus for Magnetic Separation. O. A. Zander, Stockholm, Sweden. Ore is fed to an inclined conveyor with inclined buckets passing a longitudinally moving magnetic field.

1,075,002. Surgical Instrument. I. Bandieri, Cincinnati, O. A syringe with perforated end, concentric channels for liquid and electrodes located in the annular channel.

1,075,007. Telephone System. J. G. Blessing, assignor to Automatic Electric Co., Chicago, Ill. An automatic selecting switch with relay-controlled longitudinal and rotary motions.

1,075,009. Advertising Device. F. V. Burton, assignor to Bryant Electric Co., Bridgeport, Conn. The shells of an interchangeable line of sockets and receptacles are mounted on the circumference of a disk so that they may be moved opposite any adjoining cap or base.

1,075,026. Process of Electrolysis. H. M. DuBois, Detroit, Mich. Consists in passing the liquid across the electrolytic field within a space between the diaphragm and the cathode.

1,075,029. Machine for Feeding Type. H. C. Gammeter, assignor to American Multigraph Co., Cleveland, O. Includes a motor-driven blower for an air blast to remove improperly conveyed type.

1,075,032. Trolley-Wire Crossing, Switch, and the Like. S. S. Goldman, St. Louis, Mo. Has special means for clamping the ends of the trolley wire.

1,075,036. Speed-Controller for Spinning Frames. W. T. Holmes and G. H. Whittingham, assignors to Monitor Co., Baltimore, Md. The resistance in the shunt field of the driving motor is gradually and automatically increased. (See cut.)

1,075,038. Indicator. O. S. Jones, Utica, N. Y. Includes solenoid-actuated cams.

1,075,055. Street Indicator for Electric Cars. J. E. Morton, Dallas, Tex. The ribbon is mechanically actuated through toothed wheels engaging racks at various places along the trolley wire.

1,075,075. Electric Spark-Gap. R. H. Wappler, assignor to Wappler Electric Mfg. Co., New York, N. Y. Includes a number of sparking cell units, each comprising a disk and a pair of outwardly opening cup-shaped members secured thereto.

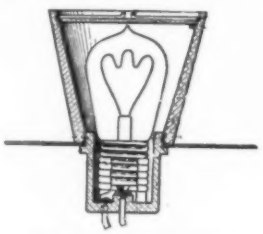
1,075,079. Coupling for Cable Sections. S. A. Armstrong, Niles, and P. T. Aumernd, Warren, O. Comprises two annular members affixed to the telephone cable sections near their ends, a sleeve joining the flared portions of these members, and nuts for locking the members to the sleeve.

1,075,093. Cylic Process of Extracting Metals from Cupriferous Materials. A. David, assignor to Midland Ores & Patents Co., New York, N. Y. Consists in leaching with a solution containing a ferric salt and a solvent of silver chloride, precipitating the dissolved copper by electrolytic iron, electrolyzing the spent solution to precipitate iron and to regenerate the solvent.

1,075,098. Cigar Lighter and Cutter. A. Gray, New York, N. Y. Includes a battery, switch, and electric igniter.

1,075,103. Apparatus for Indicating the Direction Whence Sound Travels. T. G. Hodgkinson, Chester, England, and W. Hodgkinson, Calcutta India. Includes a vibratory glass diaphragm, associated with an electric indicating circuit

1,075,149. Moving Sign. J. B. Hutchinson, Grand Rapids, Mich. Motor-driven means for oscillating a vertical three-sided prism.

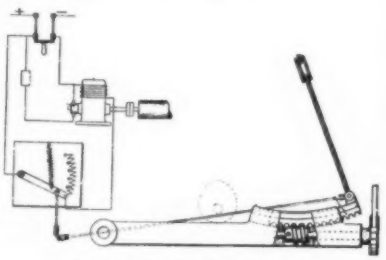


1,074,949.—Sign Lamp.

1,075,169. Railroad Signaling Device. A. Stadler, Altoona Pa., assignor of one-half to A. W. Beckman. An electric switch on a car operated by engagement of a cam with a ramp along the track.

1,075,177. Illuminable Advertising Device. F. J. Weber, Fond du Lac, Wis. An endless display band is driven by a motor over rollers and lighted by an electric lamp.

1,075,209. Welding Machine. J. H. Gravell, assignor to Hale & Kilburn Co., Philadelphia, Pa. Special work-engaging terminals are connected to the transformer secondary.



1,075,036.—Speed Controller.

1,075,217. High-Voltage Insulator. M. P. Maxwell, Brooklyn, N. Y. A locking hook for a suspension-insulator unit.

1,075,238. Electrical Switch. O. N. Wiswell, Snoqualmie, Wash. A special jaw for a knife switch has several leaves, the inner ones being curved outwardly.

1,075,257 to 1,075,260. Telephony. M. L. Johnson, assignor to Corwin Telephone Mfg. Co., Chicago, Ill. The first patent relates to special lockout features for a party line. The second patent provides for special prepayment arrangements before the message can be given to certain called lines. The last two patents include special switching arrangements for party lines to provide certain lockout features.

1,075,270. Elevator Signaling Apparatus. T. Porter, New York, N. Y., assignor of one-half to R. W. Beardslee. Includes a push-button circuit controlling a signal circuit, and a resetting circuit and transfer switch for opening the signal circuit when a car stops in response to a signal.

1,075,278. Insulated Rail Joint. R. Boone Abbot, Harrisburg, Pa. Insulating material is placed beween one rail and the connecting plate.

1,075,292. Collector Ring for Dynamo-Electric Machines. A. Kingsbury, assignor to Westinghouse Electric & Mfg. Co. Comprises a metal ring having a peripheral projection and a pair of segmental contact rings removably secured thereto and together.

1,075,295. Electrometallurgical Process of Reducing Metallic Oxids. D. A. Lyon, Palo Alto, and E. R. Cox, Jr., Heroult, Cal. A stack furnace with inclined electrodes near its base is used.

1,075,314. Electric Fire-Alarm System. J. L. Flagg and E. T. Towers, assignors to Watson-Electric Co., Paterson, N. J. Includes a generator and storage battery and a change-over switch to connect the latter when the generator is not in service.

1,075,315. Automatic Transmitter for Telegraphic Systems. J. Gell, assignor to Gell Telegraphic Appliances Syndicate, Ltd., London, England. Has main and secondary key actions interconnected.

1,075,318. Lamp Socket. T. R. Willwerscheid, St. Paul, Minn. The base of the socket is inclosed in a housing to exclude moisture.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired October 13, 1913.

569,262. Electromagnet. J. Wayland, Newark, N. J.

569,263 and 569,265. Railway-signal. J. Wayland.

569,266. Electric Bond. M. J. Wightman, Scranton, Pa.

569,278. Electric Heater. G. B. Fraley, Philadelphia, Pa.

569,299. Electric Snap Switch. C. G. Perkins, Hartford, Conn.

569,300 and 569,302. Electric Switch. W. H. Powell, Hartford, Conn.

569,305. System of Control for Electric Motors. E. A. Sperry, Cleveland, O.

569,309. Electric Snap Switch. G. B. Thomas, Hartford, Conn.

569,331. Electric Railway. A. Gorton, Philadelphia, Pa.

569,373. Cutout for Electric Circuits. L. W. Downes, Providence, R. I.

569,376. Adjustable Bracket for Transmitters. A. Y. Gordon, Massillon, O.

569,385. Magneto-Electric Generator. C. H. North, Cleveland, O.

569,401. Multiple-Station Telephone-Circuit. J. A. Barrett, Rutland, Vt.

569,424. Electric Trolley Railway Signal. H. A. Parrish, Jackson, Mich.

569,432. Electric Railway System. B. R. Shover, Indianapolis, Ind.

569,443. System of Electrical Distribution. G. T. Woods, New York, N. Y.

569,470. Telephone-Exchange System. P. E. Raverot, and George A. Hess, Paris, France.

569,538. Automatic Cutout for Electrical Transformers. A. C. Booth, Cedar Rapids, Iowa.

569,576. Electric Switch. G. Emmett, Attleborough, Mass.

569,591. Method of and Means for Electric Generation. S. H. Short, Cleveland, O.